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PALEONTOLOGY.—*A new species of* Carinocrinus *from Oklahoma.*

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I collected the specimens used in this study from the upper Pitkin formation (Chester) in the Cookson Hills, southeast of Muskogee, Okla. I consider the species to be referable to the genus *Carinocrinus* Laudon, though the arm structure is different from that of *C. stevensi* Laudon, which is the genotype species and only form heretofore known. According to the description and illustration of *C. stevensi*, the first bifurcation does not take place before the fifth primibrachials ($PBrBr_5$), whereas in *C. eventus*, n. sp., the first primibrachials are known to be axillary in at least four of the arms (the anterior ray has two known rami, but the point of branching is questionable). The arms of *C. eventus* are somewhat stouter than those of *C. stevensi* and the dorsal cup of the former species has a relatively greater length due mainly to the unusual length of the basal plates.

Laudon considered *Carinocrinus* to have probably evolved through *Culmicrinus* and was no doubt influenced by the arm structure of *C. stevensi*. The arms of *Culmicrinus* do not commence their isotomous branching until several PBrBr are formed. As noted above, this is not the case in *C. eventus*. I am inclined to consider *Gilmocrinus* Laudon as a possible ancestrial form based on the steeply conical dorsal cup and relatively stout anal sac. *Gilmocrinus* has only five arms; however, strong ramules are present and it is not unreasonable to suppose they could have evolved to regular arms.

Carinocrinus eventus, n. sp.

The dorsal cup is elongate, conical shaped, with infrabasals (IBB) readily visible in side view of the cup. The five IBB rise evenly from the round columnar attachment. Five basals (BB) are considerably longer than wide. Five radials (RR) are pentagonal, slightly wider than long. Three anal plates occupy the posterior interradius. Anal X is in full contact with post. B and extends above well into the interbrachial area. RA is almost vertical in attitude, and contacts r. post. B and post. B below, r. post. R to the right, anal X to the left, and the large RX above.

It is possible to establish at least portions of the arm structure for all five rays by observing the three type specimens. PBrBr do not fill the distal face of RR, and all observed are axillary. The anterior ray is known to have at least two arms but the PBr is missing. A second isotomous branching usually occurs with the seventh to ninth SBrBr. Thereafter, isotomous branching has been observed in most rays with the sixth to seventeenth TBr. In the right posterior ray, another division is found with the seventh QBr. The arms are becoming rather thin as preserved and most likely do not reach the termination of the massive, club shaped anal tube. Nonaxillary brachials are wedge shaped and apparently pinnular. The arms have a well-rounded exterior.

Near its base, and for a considerable portion of its length, the anal sac is composed of circlets of six plates. Along the lateral sides of each tube plate, a pore slit, or pit, is shared with the plate below and another with the adjoining plate to the right or left, as the case may be. The same is true at the upper corners. In addition, there is a pit at midlength of each lateral side which is shared by the apposing plate. This leaves a divergent ridgelike development which passes from one row of plates to the other rows. The slits first appear in the upper portions of anal X and RX, where they are more numerous than outlined above. They are present to a lesser degree in the uppermost portion of the sac; however, in that area there are numerous smaller plates interposed amongst the original circlet of

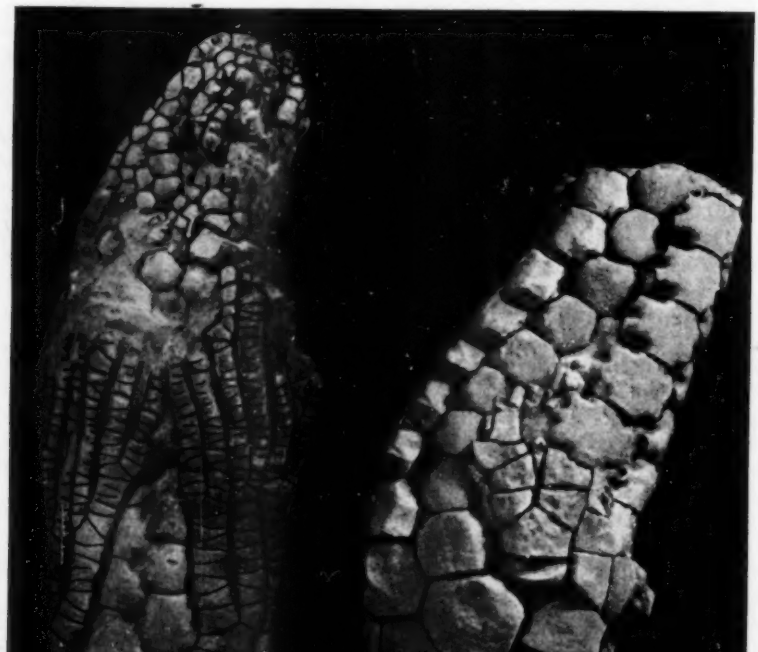
six. Some tendency toward small spine like protrusions has been observed on the terminating plates of the sac, but they are relatively inconspicous. It appears that the anal tube rises and then reverses directions so that the anal opening is very likely low on the sac. Such development was found in *C. stevensi*.

Remarks.—The outstanding differences between *C. eventus* and *C. stevensi* have been given in the preface to this description. It might be added that *C. eventus* is a more robust form but has a slightly shorter anal sac than found in *C. stevensi*.

Measurements in mm.—As follows:

	C. eventus (holotype)	*C. stevensi* (after Laudon)
Width of dorsal cup	32.2[1]	19
Height of dorsal cup	37.0	22
Width of IBB	8.2	4
Height of IBB	12.0	5
Width of BB	10.3[2]	8
Height of BB	21.1[2]	9
Width of RR	12.6[3]	10
Height of RR	8.8[3]	6
Anal sac, length	94.5	113
Anal sac, width at midlength	21.6	14
Anal sac, width at expanded distal portion	28.5	19

[1] Mildly distorted by compression.
[2] Left posterior basal.
[3] Left posterior radial.



FIGS. 1, 2.—*Carinocrinus eventus*, n. sp.: 1, Holotype from posterior, × 1; 2, paratype from right posterior, × 2.

Occurrence.—Shale break in the upper Pitkin formation, Chester, Mississippian; exposure in the bluffs overlooking the Arkansas River about 1½ miles southwest of Cedar Creek Community, which is south of Oklahoma State Highway 10, between Greenleaf Lake and Gore, Okla. The exposure is the same as the type locality of such forms as *Paianocrinus durus* Strimple, *Bronaughocrinus figuratus* Strimple, *Telikosocrinus caespes* Strimple, and others.

Types.—Holotype and two paratypes are to be deposited in the U. S. National Museum.

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BOTANY.—*Studies of South American plants, XIII.* A. C. SMITH, U. S. National Museum.

Continuing his study[1] of special families of phanerogams in South America, the writer here describes 11 new species in the families Myristicaceae, Monimiaceae, and Vacciniaceae, discussing various other noteworthy plants in these families and in the Hippocrateaceae and Ericaceae as well. The specimens upon which these notes are based were obtained in recent years by several collectors in the Andean countries from Colombia to Bolivia; most of them are deposited in the U. S. National Herbarium. Mention should also be made of a very valuable series of specimens collected in Colombia and Peru by Christopher Sandeman, kindly forwarded for study by the Director of the Royal Botanic Gardens at Kew. The place of deposit of the specimens here cited is indicated as follows: BM (British Museum [Natural History], London); Ch (Chicago Natural History Museum); Col (Instituto de Ciencias Naturales, Bogotá); K (Royal Botanic Gardens, Kew); NY (New York Botanical Garden); and US (U. S. National Museum).

MYRISTICACEAE

Virola obovata Ducke in Bol. Técn. Inst. Agron. Norte (Belém) **4:** 12. 1945.

COLOMBIA: Amazonas: Picada Cotuhé, *Schultes & Black* 46-359 (US) (open "varial," streammargin; tree 6 m high; fruit chestnut-colored).

This appears to be the second recorded collection of the species, of which the type comes from the mouth of the Javary in adjacent Brazil. As compared with a duplicate of the type (*Ducke* 1509), our specimen has the leaf-blades narrowly elliptic rather than slightly obovate, and the indument of the lower surface evanescent; the fruit is less developed than that of the type. As mentioned by Ducke, the long hairs with conspicuous lateral spurs, which are persistent on inflorescences and to a certain extent on the branchlets and petioles, characterize the species. It is further distinguished from its apparent allies, *V. calophylla* Warb. and *V. calophylloidea* Markgraf, by its acute leaf-blades. Staminate flowers are still desired accurately to ally the species, but this would seem its probable relationship.

Virola micrantha, sp. nov.

Arbor ad 20 m alta, ramulis juvenilibus gracilibus angulatis leviter flexuosis et partibus novellis copiose stellato-pilosis (pilis sessilibus ad 0.1 mm diametro, radiis 5–8), ramulis mox glabratis teretibus cinerascentibus; foliis pro genere parvis, petiolis leviter canaliculatis gracilibus 3–7 mm longis ut ramulis pilosis, laminis papyraceis vel tenuiter coriaceis in sicco fuscis, elliptico-oblongis, 4.5–7.5 cm longis, 1.8–3.2 cm latis, basi et apice obtusis (vel apice obscure mucronulatis), subtus pilis stellatis sessilibus circiter 0.1 mm diametro plerumque 4–6-radiatis inconspicue ornatis, costa supra leviter impressa subtus prominente, nervis secundariis plerumque utrinsecus 12–15 patentibus supra paullo impressis subtus subplanis, venulis utrinque saepe minute impressis; inflorescentiis ♂ paniculatis multifloris 4–6 cm longis latisque, pedunculo 1.5–2.5 cm longo et ramulis ut partibus vegetativis novellis stellato-pilosis; bracteis sub florum fasciculis submembranaceis deltoideo-orbicularibus circiter 2 mm diametro stellato-pilosis mox glabratis et caducis; floribus sessilibus in fasciculis ultimis 1.5–2.5 mm diametro 6–10 aggregatis;

[1] No. XII of this series was published in Contr. U. S. Nat. Herb. **29:** 317–393. 1950.

perianthio membranaceo circiter 1 mm longo extus stellato-puberulo fere ad basim 3-lobato, lobis oblongis obtusis; androecio 0.5–0.6 mm longo, stipite gracili utroque paullo contracto, antheris 3 minutis (haud 0.2 mm longis) omnino connatis; planta ♀ ignota.

COLOMBIA: Amazonas: Trapecio Amazónico, Quebrada Agua Preta, November 8, 1946, *R. E. Schultes & G. A. Black* 46-377 (US 1988362 TYPE) (tree 20 m high, in "varial").

This well-marked species, with graceful inflorescences and flowers which are (even for *Virola*) minute, is probably best placed in my species-group *Rugulosae* (cf. Brittonia **2:** 455 seq. 1937), where its closest ally is *V. minutiflora* Ducke. That species, however, has the leaf-blades with 30–38 pairs of secondaries and the flowers pedicellate, larger, and in ultimate clusters of 50–100. The new species also suggests some members of the species-group *Surinamenses*, in particular *V. parviflora* Ducke, but differences in foliage and in flower arrangement and size are obvious.

Virola albidiflora Ducke in Journ. Washington Acad. Sci. **26:** 259. 1936; A. C. Sm. in Brittonia **2:** 486. 1937.

COLOMBIA: Meta: Sierra de la Macarena, Central Mountains, Entrada Ridge, alt. 650 m, *Philipson, Idrobo, & Jaramillo* 2233 (BM, Col, US).

The cited specimen, in fruit, agrees excellently with earlier known material from the Solimões region of Brazil, thus extending the known range of the species into Colombia. The present collection is described as a tree 25 m high, with green fruits, occurring in dense forest.

MONIMIACEAE

Siparuna oligogyna, sp. nov.

Arbor dioica ad 8 m alta vel frutex, ramulis rectis gracilibus subteretibus ad nodos subcomplanatis apices versus sublepidoto-pilosis (pilis pallidis stellatis 0.15–0.3 mm diametro radiis 8–25 centrum versus adnatis); foliis oppositis, petiolis gracilibus leviter canaliculatis 8–17 mm longis ut ramulis pilosis, laminis papyraceis in sicco viridi-olivaceis, obovato- vel lanceolato-ellipticis, 9–18 cm longis, 3.5–6.5 cm latis, basi acutis et in petiolum decurrentibus, apice cuspidatis (apice ipso obtuso ad 1.5 cm longo), margine integris et anguste recurvatis, supra glabris vel secus nervos sparsim stellato-pilosis, subtus pilis eis ramulorum similibus saepe dispersis ornatis, costa supra leviter elevata subtus prominente, nervis secundariis utrinsecus 7–9 arcuato-adscendentibus supra prominulis subtus elevatis, nervis tertiariis transversis et rete venularum utrinque inconspicue prominulis; inflorescentiis ♂ axillaribus solitariis vel binis cymosis 2–3 cm longis multifloris ubique ut ramulis juvenilibus flavescenti-sublepidoto-pilosis, pedunculo 5–10 mm longo, ramis paucis, pedicellis sub anthesi 1–1.2 mm longis; floribus ♂ circiter 2 × 1.5 mm, receptaculo obovoideo tenuiter carnoso margine apicali integro lato, tepalis et velo omnino nullis; staminibus 12–14 subaequalibus liberis leviter exsertis, filamentis membranaceis deltoideo-ligulatis circiter 0.5 mm longis copiose glandulosis, antheris minutis apice obtusis; inflorescentiis ♀ similibus, floribus paucioribus sub anthesi circiter 2.5 mm longis, receptaculo ellipsoideo carnoso ♂ simili, tepalis obsoletis; carpellis 3–5, stylis liberis filiformibus longe exsertis; drupis immaturis obovoideis ad 7 mm longis persistenter pilosis.

COLOMBIA: Meta: Sierra de la Macarena, Río Guapaya, alt. 500 m, January 21, 1950, *W. R. Philipson, J. M. Idrobo, & R. Jaramillo* 2195 (BM, Col, US 2026249 TYPE) (tree 8 m high, in dense humid forest; flowers yellow); same locality, alt. 450 m, *Philipson, Idrobo, & Fernández* 1629 (BM, Col, US) (shrub, in dense forest on bank of river; flowers greenish; fruits green).

The new species is characterized by its small flowers, with obsolete tepals and lacking a velum, and by its indument, which is composed of minute stellate hairs with 8–25 rays connate toward the depressed center. The trichome thus suggests a scale, but since its rays are free for most of their length it is probably best defined as a stellate hair. The closest ally of the new species is the Ecuadorian *S. eggersii* Hieron., which has a similar but sparser indument, leaf-margins usually obviously sinuate-dentate, larger flowers with obvious but small tepals, fewer stamens, and more numerous carpels. The type of *S. oligogyna* is from a staminate plant, while no. 1629 bears pistillate flowers and young fruits.

Siparuna idroboi, sp. nov.

Arbor mediocris, ramulis teretibus copiose stellato-tomentellis (pilis stramineis, radiis plerumque 5–10 adscendentibus longitudine di-

versis 0.4–0.8 mm longis); foliis oppositis, petiolis gracilibus subteretibus valde diversis 2–6 cm longis ut ramulis dense tomentellis, laminis papyraceis in sicco fusco-viridibus subtus pallidioribus, anguste ellipticis, 15–27 cm longis, 6–11.5 cm latis, basi obtusis vel acutis, ad apicem circiter 1 cm longum calloso-obtusum gradatim angustatis, margine inconspicue undulato-crenulatis, ubique stellato-pilosis, pilis faciei superioris radiis 2–5 adscendentibus 0.2–0.4 mm longis, pilis faciei inferioris et supra ad nervos longioribus, radiis plerumque 5–12 ad 0.5 mm longis, costa supra paullo elevata subtus prominente, nervis secundariis utrinsecus 14–16 erecto-patentibus subrectis supra leviter subtus valde elevatis, rete venularum supra plano subtus prominulo, venulis nonnullis in dentes marginales terminantibus; inflorescentiis ♂ axillaribus cymosis solitariis vel binis multifloris 2–3 cm longis ubique pilis 0.2–0.3 mm longis tomentellis, pedunculo gracili 5–8 mm longo, ramulis paucis basi pedicellorum delapsorum conspicue incrassatis; pedicellis gracilibus sub anthesi 4–5 mm longis, floribus obconicis circiter 3 mm longis et 4 mm latis; receptaculo subcarnoso, limbo patente crenulato e tepalis plerumque 6 rotundatis circiter 1 x 1.5 mm incrassatis composito apice circumdato, velo inconspicuo complanato circiter 0.5 mm lato, ore lato; staminibus 10–12 liberis 2- vel 3-seriatis leviter exsertis, extimis maximis, filamentis carnosis oblongo-deltoideis ad 1.2 mm longis latisque luteo-glandulosis, antheris magnis; inflorescentiis ♀ non visis.

COLOMBIA: Meta: Cordillera La Macarena (extreme northeast), Macizo Renjifo, eastern slopes, alt. 600–1300 m, December 30, 1950–January 5, 1951, *J. M. Idrobo & R. E. Schultes* 846 (US 2026030 TYPE) (medium-sized tree).

The new species is characterized by its large, thin leaves, its copious stellate indument (the hairs of which, however, do not conceal the leaf-surface), its flowers with an inconspicuous crenulate rim of small tepals, its flattened velum, and its 10–12 free stamens. It seems most closely related to the Bolivian *S. cinerea* Perk., from which it is readily distinguished by its large, long-petiolate, acuminate leaves and its more numerous stamens. *Siparuna idroboi* superficially suggests *S. chiridota* (Tul.) A. DC., but that species has the foliage-indument appressed to the leaf-surface rather than ascending, and its stamens are very different, the four marginal stamens surrounding a single central one.

HIPPOCRATEACEAE

Salacia opacifolia (Macbr.) A. C. Sm. in Brittonia **3**: 434. 1940.

COLOMBIA: Amazonas: Trapecio Amazónico, Loretoyacu River, alt. about 100 m, on varzea land, *Schultes & Black* 46-300 (US) (flowers yellow).

This is the first Colombian record of a species known from several collections in Amazonian Peru and adjacent Brazil.

Salacia gigantea Loes. in Verh. Bot. Ver. Brand. **48**: 182. 1907; A. C. Sm. in Brittonia **3**: 450. 1940.

COLOMBIA: Amazonas: Trapecio Amazónico, Loretoyacu River, alt. about 100 m, *Schultes & Black* 8296 (US).

The cited specimen is the third collection of the species known to me, the others being from Brazil (Rio Jurua, the type locality, and Rio Solimões).

Tontelea congestiflora (A. C. Sm.) A. C. Sm. in Brittonia **3**: 496. 1940.

COLOMBIA: Vaupés: Río Kananarí and Cerro Isibukuri, alt. 250–700 m, *García-Barriga* 13806 (US) (shrub 2 m high, the flowers red).

This species has previously been known only from the two Krukoff collections from Amazonian Brazil cited by me. The morphology of the species is of particular interest because it represents a unique condition in *Tontelea*, being the only species of the genus that has entire stigmas opposite the stamens. The Colombian specimen agrees in every fundamental respect with those previously known, its inflorescence (to 3 cm long) and petals (to 2.2 mm long) being slightly larger than those described.

Peritassa laevigata (Hoffmanns.) A. C. Sm. in Brittonia **3**: 508. *fig. 11, a–h*. 1940.

COLOMBIA: Meta: Sierra de la Macarena, Central Mountains, North Ridge, alt. 1400 m., *Philipson & Idrobo* 1944 (BM, Col, US). Vaupés: Maviso, *Romero* 1257 (US).

This widespread and rather variable species is here first recorded from Colombia. Romero notes the local name as "huevo de gato" and states that the fruit is edible.

Cheiloclinium obtusum A. C. Sm. in Brittonia **3**: 545. 1940.

BRAZIL: Amazonas: Rio Vaupés, between

Ipanoré and confluence with Rio Negro, Igarapé da Chuva, Taracuá, *Schultes & Murça Pires* 9071 (US) (liana, with small yellow flowers).

The cited collection, the second known for the species, agrees excellently with the type, from the vicinity of Iquitos, Peru.

ERICACEAE

Befaria nana A. C. Sm. & Ewan in Contr. U. S. Nat. Herb. **29**: 333. 1950.

VENEZUELA: Zulia: Perijá, alt. 2800–2900 m, *Bro. Ginés* 1985 (US) (small shrub on páramo; flowers red).

Among the interesting specimens recently collected by Brother Ginés in Zulia occurs the second collection of *B. nana*, otherwise known only from the type, obtained in the adjacent Colombian portion of the Sierra Perijá. The new material is somewhat the more robust and has a slightly different indument, but the deviation is not surprising in *Befaria*, of which the species are extremely variable. The original description may now be amplified as follows:

Glandular hairs of the branchlets and pedicels up to 2 mm in length (hairs of this type also present on both surfaces of leaves, especially along the costa beneath), the softer, canescent indument of the type specimen completely lacking in *Ginés* 1985; leaf-blades up to 22 mm long and 3 mm broad; inflorescence similarly terminal but comparatively elongate, the rachis up to 3.5 cm long, the pedicellary bracteoles about 3 mm long.

Tepuia speciosa A. C. Sm. in Contr. U. S. Nat. Herb. **29**: 336. 1950.

VENEZUELA: Bolívar: Mount Auyan-tepuí, alt. 2,100 m, *Cardona* 2659 (US).

The second collection of this very distinct species, from the type locality, agrees excellently with Cardona's earlier material (no. 257) upon which the species was based. Of considerable interest also are additional specimens from the type locality of two of the original species of the remarkable genus *Tepuia*, based upon earlier collections from Auyan-tepuí (cf. Camp in Brittonia **3**: 178–184, *fig. 4, 5*. 1939). These collections represent *T. tatei* Camp (*Cardona* 2667, US) and *T. venusta* Camp (*Cardona* 2666, US).

Pernettya purpurascens (H. B. K.) comb. nov. *"Gualtheria" purpurascens* H. B. K. Nov. Gen. & Sp. **3**: 282. 1818.

COLOMBIA: *Humboldt & Bonpland* (TYPE in herb. Paris; photo. of isotype in herb. Berlin, Chi. Nat. Hist. Mus. photo. no. 4759, in US, etc.); Cundinamarca: Páramo de Choachi, near Bogotá, alt. 3300–3500 m., *Pennell* 2218 (NY, US) (shrub on dry páramo; fruit black-purple); Páramo de Guasca, 8 km east of Guasca, alt. 3500–3600 m, *Fosberg* 21701 (US) (prostrate, occasional in open spots on ridges; lower surface of leaves purple; ripe fruit black).

Gaultheria purpurascens is apparently a very rare plant, and perhaps for this reason the fact that it is referable to *Pernettya* has been overlooked. The three specimens known to me are all in fruit and in this condition unmistakably represent *Pernettya*, the calyx-lobes remaining small and free from the mature fruit. The species is not accounted for in Sleumer's revision of *Pernettya* (in Notizbl. Bot. Gart. Berlin **12**: 626–655. 1935), and it appears not to have been redescribed in either genus. Its position in *Pernettya* is very distinct, the long, stiff, bristlelike hairs that cover both sides of the leaves and the distal parts of branches immediately distinguishing it; its relationship to the forms of *P. prostrata* (Cav.) Sleumer that occur in the Andes seems remote.

VACCINIACEAE[2]

Gaylussacia cardenasii, sp. nov.

Frutex ad 3 m altus, ramulis gracilibus subteretibus cinereis apices versus dense foliatis et copiose puberulo-tomentellis (pilis albidis ad 0.5 mm longis) mox glabratis; petiolis gracilibus canaliculatis 2–2.5 mm longis ut ramulis puberulis glabratisque; foliorum laminis subcoriaceis in sicco olivaceis oblongis, (2–) 2.5–4 cm longis, 0.8–1.2 cm latis, basi obtusis vel subacutis, apice obtusis vel rotundatis atque glandula crassiuscula prominente terminatis, margine leviter recurvatis obscure crenulatis vel subintegris, junioribus utrinque copiose luteo-glandulosis et praecipue marginem versus parce puberulis, maturis glabratis glandulis obscuris, costa supra subplana (in foliis maturis impressa) subtus elevata, nervis secundariis utrinsecus 4–6 subadscendentibus et rete venularum utrinque primo prominulis demum subimmersis; racemis axillaribus 8–12-floris basi bracteis circumdatis,

[2] The genera of Vacciniaceae are discussed in the sequence proposed by Sleumer in Bot. Jahrb. **71**: 386–389. 1941.

bracteis imbricatis papyraceis margine breviciliolatis, extimis semiorbicularibus, intimis obovatis ad 6 mm longis, rhachi gracili tereti pilis albidis 0.1–0.2 mm longis copiose puberula ac etiam dispersim luteo-glandulosa, glandulis interdum brevi-stipitatis; bracteis sub floribus papyraceis oblongis vel obovato-ellipticis, 6–9 mm longis, 4–6 mm latis, saepe apiculatis, utrinque obscure puberulis etiam luteo-glandulosis; pedicellis gracilibus sub anthesi 2–4 mm longis ut rhachi puberulis et glandulosis supra medium bibracteolatis, bracteolis lineari-oblanceolatis 3–4 mm longis 0.5–1 mm latis pariter indutis; calyce sub anthesi 3–4 mm longo apice circiter 5 mm diametro, tubo breviter cupuliformi pilis patentibus 0.5–1 mm longis capitato-glandulosis copiose hispidulo etiam glandulis numerosis subsessilibus ornato, limbo campanulato-rotato dorso sessiliglanduloso intus glabro, margine puberulociliolato etiam glandulis brevi-stipitatis copiose ornato, lobis 5 ovato-deltoideis obtusis 2–2.5 mm longis latisque; disco pulvinato centrum versus obscure puberulo; corolla submembranacea maturitate campanulata circiter 6 mm longa apice 6–7 mm diametro, utrinque glabra vel extus pilis paucis brevi-stipitatis glandulosis ornata, lobis 5 deltoideis obtusis circiter 3 mm longis latisque saepe recurvatis; staminibus 10 ad 3.8 mm longis, filamentis liberis ligulatis circiter 1.5 mm longis ubique adscendenti-albidopuberulis, antheris 2.5–2.7 mm longis, thecis circiter 1 mm longis basi obtusis, tubulis per rimas ovales introrsas dehiscentibus; stylo crasso tereti circiter 5 mm longo basim versus puberulo, stigmate minute peltato.

BOLIVIA: Santa Cruz: Samaipata, "El Fuerte," alt. 1700 m, November 1950, *M. Cárdenas* 4643 (US 2027184 TYPE) (shrub 2–3 m high, on grassy slopes; flowers pinkish).

The species here described is not closely allied to the known Andean species of *Gaylussacia*, being very different from those recently described by Sleumer as *G. loxensis* and *G. peruviana* (in Bot. Jahrb. **71**: 384–385. 1941). It is more closely related to those few Brazilian species that have short, campanulate corollas and a glandular indument, perhaps especially to *G. rugosa* Cham. & Schlechtend., from which it differs in its narrower leaf-blades, which are subacute or obtuse at apex rather than prevailingly retuse. The new species, as compared with *G. rugosa*, has a shorter inflorescence and a different distribution of glandular hairs; in the Brazilian species such hairs are present on the branchlets, rachis, and pedicels as well as on the calyx, but in *G. cardenasii* the glands are very nearly sessile except on the calyx-tube.

Sphyrospermum haughtii, sp. nov.

Frutex gracilis, ramulis elongatis teretibus inconspicue flexuosis apices versus 0.6–0.8 mm diametro breviter villosis (pilis pallidis 0.5–1 mm longis) demum cinereis glabratisque; petiolis gracilibus subteretibus 0.5–1 mm longis ut ramulis pilosis et glabratis; laminis in sicco coriaceis ut videtur in vivo carnosis opacis, ovatis, (2–) 2.5–3 cm longis, (1.2–) 1.5–1.8 cm latis, basi rotundatis, apice gradatim acuminatis (apice ipso saepe 5 mm longo calloso-obtuso), margine integris incrassatis anguste recurvatis, utrinque primo inconspicue pallido-pilosis (pilis ad 0.5 mm longis) mox glabratis vel subtus pilos castaneos glandulosos minutos dispersim gerentibus, costa et nervis secundariis plerumque 4 basim versus orientibus obscuris immersis, venulis immersis; inflorescentia axillari 1- vel 2-flora quam foliis breviore, rhachi subnulla, bracteis sub floribus lanceolatis 0.7–1 mm longis parce villosis, pedicellis gracilibus teretibus sub anthesi 7–10 mm longis ut calyce copiose villoso-puberulis (pilis albidis 0.2–0.4 mm longis) infra medium bibracteolatis, bracteolis linearibus circiter 0.7 mm longis; calyce sub anthesi 4–5 mm longo et apice diametro, tubo turbinato 2.5–3 mm longo et lato basi acuto apice leviter contracto, limbo erecto-patente papyraceo intus glabro 5-lobato, lobis late deltoideis acutis 0.6–1 mm longis, sinubus rotundatis; disco annulari-pulvinato glabro; corolla carnosa urceolata sub anthesi circiter 6 mm longa et 4.5 mm diametro praeter lobos interdum puberulos ubique glabra, lobis 5 deltoideis acutis circiter 0.7 mm longis; staminibus 10 quam corolla paullo brevioribus alternatim leviter inaequalibus, filamentis ligulatis alternatim circiter 1 mm et 1.5 mm longis superne pilis circiter 0.5 mm longis pallido-villosulis, antheris 3.5–4 mm longis, thecis circiter 1.5 mm longis basi rotundatis, tubulis quam thecis longioribus gracillimis per rimas ovales circiter 0.5 mm longas dehiscentibus; stylo gracili corollam fere aequante; fructibus juvenilibus obovoideis et calycis limbo persistenter pilosis.

ECUADOR: Bolívar: Road above Balzapamba, alt. 2,400 m, May 3, 1942, *O. Haught* 3302 (US 1708049 TYPE) (rock plant, the shoots ascending

or trailing, the leaves rather thick; flowers very pale yellow).

The new species is characterized by its thick, acuminate leaves, short-pedicellate flowers, uniformly villose-puberulent calyx, urceolate glabrous corolla, and stamens with very slender tubules. In general it seems most closely allied to *S. sodiroi* (Hoer.) A. C. Sm., but that species has somewhat smaller, obtuse to subacute leaves, the corolla cylindric, at least 9 mm long and copiously villose, and stamens with comparatively long filaments.

Sphyrospermum buesii, sp. nov.

Frutex forsan epiphyticus et dependens, ramulis elongatis gracilibus apicēs versus hispidulo-puberulis (pilis pallidis ad 1 mm longis) demum glabratis, ad nodos incrassatis; petiolis gracilibus subteretibus circiter 1.5 mm longis ut ramulis pilosis; laminis coriaceis ut videtur in vivo carnosis opacis, oblongo-lanceolatis, (2–) 2.5–3 cm longis, 0.8–1.2 cm latis, basi obtusis vel anguste rotundatis, apice gradatim acuminatis et calloso-obtusis, margine incrassatis et anguste recurvatis, utrinque parce pilosis (pilis pallidis ad 1 mm longis) mox glabratis, e basi 3- vel 5-nerviis, nervis et venulis immersis; inflorescentia axillari 1- vel 2-flora quam foliis breviore, basi bracteis paucis ovato-deltoideis acutis 1–2 mm longis parce hispidulis circumdata, rhachi subnulla, pedicellis gracilibus sub anthesi 4–7 mm longis mox glabratis; calyce sub anthesi circiter 6 mm longo et apice 4 mm diametro extus pilis pallidis 0.6–0.8 mm longis copiose tomentello, tubo ellipsoideo 2–3 mm longo 1.5–2 mm diametro, limbo suberecto tubum excedente papyraceo intus glabro profunde 4- vel 5-lobato, lobis lanceolatis 2–2.5 mm longis subacutis, sinubus acutis; disco annulari-pulvinato glabro; corolla tenuiter carnosa urceolata sub anthesi 7–8 mm longa et medium versus circiter 4 mm diametro, basi et apice valde contracta, superne pilis castaneis 0.1–0.3 mm longis parce glanduloso-pilosa, lobis 4 vel 5 oblongis subacutis circiter 1 mm longis; staminibus 8 vel 10 similibus longitudine corollam fere aequantibus glabris, filamentis gracilibus ligulatis circiter 3 mm longis, antheris circiter 3.5 mm longis, thecis 1.5–2 mm longis basi obtusis, tubulis gracilibus thecas subaequantibus per rimas elongatas 1 mm vel ultra longas dehiscentibus; stylo gracili corollam subaequante.

PERU: Cusco: Yanatín Palmacocha, Alturas de Chaco, Prov. Convención, alt. about 2700 m, August 15, 1928, *C. Bues* 2165 (US 1423528 TYPE) (collected in the "ceja de la montaña").

Although the relationship of this new species appears to be with *S. sodiroi* (Hoer.) A. C. Sm. and the above described *S. haughtii*, it is very distinct from both on the basis of its proportionately narrower leaves and its elongate calyx with lanceolate lobes and acute sinuses. It is further distinguished from *S. sodiroi* by its shorter, essentially glabrous corolla and its shorter filaments, and from *S. haughtii* by its shorter pedicels, slightly longer corolla and filaments, and short anther-tubules dehiscing by comparatively elongate clefts.

Killipiella stereophylla A. C. Sm. in Contr. U. S. Nat. Herb. **29**: 357. 1950.

COLOMBIA: Nariño: Río Nembi, *André* 3399 (K) (May 23, 1876; scandent; flowers whitish rose).

The second known collection of this recently described species comes from essentially the type locality, the Río Nembi being a small tributary of the Río Cuaiquer about 20 km west of Ricaurte, the locality of von Sneidern's type (no. 612). In floral characters the two specimens are nearly identical, but the leaf-blades of the André specimen are only 10–15 mm long by 3–6 mm broad, somewhat smaller than those of the type.

Notopora cardonae, sp. nov.

Frutex ad 2 m altus multiramosus, ramulis rigidis teretibus gracilibus purpureo-fuscis copiose pubescentibus (pilis albidis debilibus patentibus 0.5–1 mm longis) demum glabratis cinerascentibus lenticellatis; foliis confertis saepe subimbricatis, petiolis teretibus rugulosis 2–3 mm longis validis (circiter 1 mm diametro) ut ramulis juvenilibus pilosis (pilis 0.2–0.5 mm longis); foliorum laminis rigide coriaceis in sicco fusco-olivaceis, plus minusve orbicularibus, 1.2–2 cm longis latisque, basi rotundatis vel minute cordatis, apice rotundatis (apice ipso obscure calloso), margine valde recurvatis vel subrevolutis, supra ut petiolis molliter pilosis, subtus sparsius vel secus costam pilosis, demum interdum subglabratis, subtus immerso-glandulosis, inconspicue pinnatinerviis, costa supra subplana subtus leviter elevata, nervis secundariis utrinsecus 3–5

patentibus et rete venularum supra interdum inconspicue prominulis subtus planis vel immersis; inflorescentia axillari uniflora, rhachi subnulla; pedicellis teretibus validis, in sicco 0.7–1 mm diametro rugulosis, sub anthesi 3–5 mm longis, ut petiolis pilosis, basi bracteis pluribus imbricatis subcoriaceis deltoideis acutis ad 0.5 mm longis parce pilosis circumdatis, paullo supra medium bibracteolatis (bracteolis bracteis similibus 1–1.3 mm longis), cum calyce conspicue articulatis; calyce in sicco subcoriaceo, 5–5.5 mm longo, 4.5–5 mm apice diametro, extus ut pedicellis parce piloso mox glabrato, tubo cupuliformi circiter 2 mm longo ad sinus inconspicue 5-angulato, limbo campanulato quam tubo longiore margine pilis circiter 0.5 mm longis persistenter ciliato 5-lobato, lobis deltoideis acutis 1–1.5 mm longis, sinubus rotundatis; disco carnoso annulari-pulvinato glabro; corolla cylindrico-subclavata tenuiter carnosa sub anthesi 22–25 mm longa et supra medium 5–6 mm diametro, utrinque glabra, lobis 5 sub anthesi patentibus oblongo-deltoideis obtusis 2–3 mm longis; staminibus 10 longitudine corollam fere aequantibus glabris similibus, filamentis subcarnosis ligulatis 15–17 mm longis primo corollam adhaerentibus mox liberis, antheras dorso apice thecarum adnexis, antheris validis 5–6 mm longis, thecis granulatis 3.5–4 mm longis basi obtusis, tubulis quam thecis brevioribus erectis liberis amplis per rimas ovales dorsales 1.5–2 mm longas dehiscentibus; stylo gracili tereti corollam subaequante, stigmate minute peltato; fructibus juvenilibus ellipsoideis coriaceis levibus 5–6 mm longis calycis limbo persistente coronatis.

VENEZUELA: Bolívar: Summit of Mount Auyan-tepuí, Alto Caroní, alt. 2500 m, January 1949, *F. Cardona* 2656 (US 1997672 TYPE) (shrub 2 m high; corolla red).

The remarkable plant here described, another representative of the highly endemic flora of Mount Auyan-tepuí, does not at first glance suggest the supposedly monotypic genus *Notopora*, which has been extended in range but not in number of species since its proposal in 1876 (Hook. f. in Hook. Ic. Pl. **12**: 53. *pl. 1159*). However, the stamens with elongate filaments and short, dorsally dehiscing anthers permit of no other disposition of Cardona's plant. From *N. schomburgkii* Hook. f. our species is distinguished by many striking characters, most obviously by its small, coriaceous, suborbicular leaves with a sparser and quite different indument, its flowers lacking the persistent brown tomentum that covers both calyx and corolla in the older species, its comparatively small calyx, and its longer corolla and filaments.

Psammisia fissilis A. C. Sm. in Contr. U. S. Nat. Herb. **29**: 372. 1950.

PERU: San Martín: Almirante, Rioja [west of Moyobamba], *Sandeman*, August 1938 (K) (tall shrubby tree, growing in semi-shade in rainforest; corolla bright red).

This unnumbered Sandeman specimen represents the third known collection of the species and the first from Peru; the species was described on the basis of two Steyermark collections from the Province of Loja, Ecuador. The present specimen agrees excellently with the type (although the Ecuadorean specimens were indicated as lianas or epiphytic shrubs), except that its inflorescence-rachis is less than 1 cm long and bears only 4–6 flowers. In view of the similarity of foliage and floral parts, one cannot consider the compact inflorescence consequential.

Thibaudia pachyantha A. C. Sm. in Contr. U. S. Nat. Herb. **28**: 415. 1932.

COLOMBIA: Nariño: Barbacoas, between Corregimiento Santander (Buenavista) and Barbacoas (mouth of Río Telembí), alt. 200–840 m, *García-Barriga* 13121 (US).

The cited specimen represents the second collection of this very distinct species, which otherwise has been known only from the type, collected by Triana also in Nariño. The García-Barriga specimen is somewhat better preserved than the type and larger in some of its parts, having the lead-blades up to 18 cm long and 12 cm broad and gradually narrowed to an acuminate apex, while some of the pedicels are as long as 5.5 cm. The plant is said to be a small tree 3 m high, with red pedicels and corollas and yellowish-green calyces.

Plutarchia monantha, sp. nov.

Frutex parvus ubique plus minusve glaber, partibus novellis obscure puberulis, ramulis gracilibus apices versus circiter 2 mm diametro angulatis; stipulis intrapetiolaribus ovatis obtusis circiter 1.5 mm longis mox caducis; foliis parvis confertis, petiolis rugulosis canaliculatis 2–4 mm longis, laminis coriaceis in sicco olivaceis ovatis, (10–) 15–25 mm longis, (6–) 8–13 mm latis, basi truncato-rotundatis, apice calloso-acutis,

margine integris incrassatis, juventute subtus interdum parce glanduloso-strigosis, obscure pinnatinerviis, costa supra leviter impressa subtus elevata, nervis secundariis utrinsecus circiter 3 immersis; floribus axillaribus solitariis subsessilibus basi bracteis pluribus imbricatis circumdatis, bracteis extimis parvis reniformibus interdum glanduloso-marginatis, intimis maximis papyraceis ellipticis ad 11 mm longis et 7 mm latis margine scariosis et parce ciliolatis, omnino caducis; pedicellis 0.5–1.5 mm longis primo minute puberulis ut videtur ebracteolatis; calyce sub anthesi circiter 11 mm longo et apice diametro, tubo coriaceo in sicco angulato basi truncato circiter 2.5 mm longo, limbo papyraceo erecto-patente fere ad basim 5-lobato, lobis lanceolatis acutis 7–8 mm longis, 2.5–3 mm latis margine glanduloso-ciliolatis; corolla carnosa ample cylindrica sub anthesi 21–23 mm longa et circiter 8 mm diametro, lobis 5 deltoideis acutis circiter 1.5 x 3 mm; staminibus 10 similibus longitudine corollam fere aequantibus, filamentis liberis ligulatis circiter 2.5 mm longis superne pilis ad 0.5 mm longis ciliolato-marginatis, antheris 17–18 mm longis, thecis 4–4.5 mm longis basi obtusis et incurvatis, tubulis quam thecis multo longioribus per rimas distales ad 2 mm longas dehiscentibus; stylo tereti corollam subaequante.

COLOMBIA: Caldas: Vicinity of Manizales, alt. about 3,300 m, January 1948, *Christopher Sandeman* 5694 (K TYPE) (subshrub, with coriaceous, bright green leaves; corolla cherry-red, greenish white at apex).

The beautiful little *Plutarchia* here described is closely related only to the recently proposed *P. minor* A. C. Sm. (in Contr. U. S. Nat. Herb. **29:** 380. 1950), differing in its ovate, larger, acute leaf-blades and its subsessile, somewhat larger flowers. From the only other species of this immediate alliance, *P. rigida* (Benth.) A. C. Sm., the new species is distinguished by its smaller leaves, solitary flowers, and smaller calyx-lobes, corolla, and stamens.

Cavendishia porphyrea A. C. Sm. in Contr. U. S. Nat. Herb. **29:** 383. 1950.

COLOMBIA: Nariño: Barbacoas, between Corregimiento Santander (Buenavista) and Barbacoas (mouth of Río Telembí), alt. 200–840 m, *García-Barriga* 13125 (US).

The cited specimen agrees excellently with the type and only other known specimen of this recently described species, from the Department of Cauca at low elevation. The Nariño material has slightly larger leaves than those described, the blades being up to 8 cm long and 2.5 cm broad, proportionately somewhat narrower than those of the type but with the same abrupt and slender acumen (up to 25 mm long). The flowers of the García-Barriga specimen are slightly smaller than those of the type, having the calyx about 6 mm long and the corolla about 30 mm long, with proportionately smaller stamens. These differences are no more than individual in an extremely well-marked species.

Cavendishia sandemanii, sp. nov.

Frutex, ramulis subteretibus glabris apices versus stramineis circiter 3 mm diametro inferne purpureo-cinereis; petiolis semiteretibus rugulosis 2–4 mm longis supra paullo puberulis; foliorum laminis coriaceis in sicco olivaceis, oblongo-ovatis, (3.5–) 5–6 cm longis, (2–) 2.5–3 cm latis, basi rotundatis vel subcordatis, apice obtusis vel obtuse brevi-cuspidatis, margine integris leviter recurvatis, supra glabris, subtus minute glanduloso-strigillosis mox glabratis, costa supra paullo impressa subtus elevata, nervis secundariis utrinsecus 2 vel 3 e basi vel paullo supra orientibus adscendentibus costa similibus, extimis saepe obscuris, rete venularum immerso; inflorescentia apices ramulorum versus axillari racemosa multiflora basi bracteis subcoriaceis semiorbicularibus dorso subpuberulis intimis ad 4 x 5 mm circumdata, rhachi gracili glabra (3–) 4–6.5 cm longa, bracteis sub floribus papyraceis glabris obovato-oblongis ad 25 mm longis et 12 mm latis; pedicellis gracilibus teretibus rugulosis sub anthesi et fructu 12–15 mm longis, superne inconspicue sessili-glandulosis, basim versus manifeste bibracteolatis, bracteolis papyraceis lineari-lanceolatis 5–6 mm longis, 0.7–1 mm latis, glandulas paucas marginales gerentibus; calyce sub anthesi circiter 5 mm longo et 7 mm apice diametro, tubo coriaceo cupuliformi 2–2.5 mm longo ruguloso glandulis pallidis dispersis sessilibus ornato, limbo subpatente papyraceo tubum subaequante glabro 5- vel 6-lobato, lobis late deltoideis acutis circiter 1 mm longis glandulas lineares subapicales gerentibus, sinubus rotundatis; corolla tenuiter carnosa cylindrica sub anthesi circiter 15 mm longa et 5 mm diametro extus pilis ad 0.5 mm longis albidis copiose puberula intus glabra, lobis 5 vel 6 oblongis obtusis 1–1.5 mm longis; staminibus 10 vel 12 longitudine subaequalibus circiter 14 mm

longis, filamentis liberis ligulatis superne intus puberulis alternatim circiter 1.5 mm et 2 mm longis, antheris paullo inaequalibus, thecis 4–4.5 mm longis, tubulis 8–9 mm longis per rimas elongatas dehiscentibus; stylo tereti corollam subaequante; fructibus juvenilibus subglobosis ad 6 mm longis glabris, pedicellorum bracteolis subpersistentibus.

COLOMBIA: Boyacá or Santander: Between Paipa (Boyacá) and San Gil (Santander), alt. about 3,000 m, May 1948, *Christopher Sandeman* 6015 (K TYPE) (shrub, growing in full exposure in moist places; corolla bright cherry-red).

In foliage and fundamental floral characters the new species is very similar to *C. cordifolia* (H. B. K.) Hoer., but it seems to merit specific recognition because of its elongate racemes (the rachis in *C. cordifolia* being insignificant, only rarely approaching 3 cm in length) and its long, linear-lanceolate pedicellary bracteoles (those of *C. cordifolia* being usually 1–3 mm long and comparatively evanescent). The pedicels and calyces of *C. cordifolia* are usually copiously pilose at anthesis and frequently persistently so, its vegetative parts are often white-pilose, and its pedicels only rarely exceed 10 mm in length. The occasionally 6-merous flowers of the new species are probably not significant. *Cavendishia cordifolia* is now known from a great number of specimens from the Eastern Cordillera of Colombia and is quite homogeneous, so that the inclusion of the extreme form here described as *C. sandemanii* at present seems unwarranted.

Cavendishia rigidifolia A. C. Sm. in Contr. U. S. Nat. Herb. **28**: 500. 1932.

COLOMBIA: Antioquia: Medellín, Río Negro, alt. about 2,100 m, *Sandeman* 5660 (K) (tall straggling shrub, growing in full exposure and in semi-shade; corolla pink, tinged with white); Medellín, camino viejo al Alto de Santa Elena, alt. about 2,300 m, *Uribe Uribe* 2073 (US) (shrub; corolla red).

The second and third known collections of this rare species, like the type, were obtained in Antioquia; they agree with the type in all essential characters, but the leaves are slightly smaller (petioles sometimes only 3 mm long; leaf-blades toward apices of branchlets as small as 10 by 2 cm, but more often at least 13 by 2.5 cm, with the same proportions, texture, and venation as those of the type).

Orthaea ferreyrae, sp. nov.

Frutex ad 5 m altus, ramulis rectis subteretibus vel superne angulatis apices versus 1.5–3 mm diametro puberulis (pilis patentibus albidis ad 0.4 mm longis) vel glabris cinerascentibus; stipulis intrapetiolaribus interdum persistentibus lanceolatis 2–5 mm longis; petiolis semiteretibus vel canaliculatis rugulosis 3–5 mm longis ut ramulis puberulis vel glabris, foliorum laminis in sicco subcoriaceis fusco-olivaceis, lanceolatis, (5–) 7–11 cm longis, 1.5–3 cm latis, basi obtusis, superne ad apicem 1–2 cm longum mucronulatum gradatim angustatis, margine integris incrassatis saepe recurvatis, utrinque glabris vel subtus inconspicue glanduloso-strigosis vel secus costam breviter pilosis, costa supra impressa subtus prominente, nervis secundariis utrinsecus 2 vel 3 adscendentibus inconspicuis supra planis vel prominulis, intimis cum costa 5–20 mm interdum concurrentibus subtus paullo elevatis, aliis e basi orientibus interdum subimmersis, nervis tertiariis e costa paucis inconspicuis et rete venularum immersis vel supra subprominulis; inflorescentia axillari racemosa 10–20-flora (floribus sub anthesi paucioribus) basi bracteis mox caducis circumdata, rhachi (2–) 3–7 cm longa ut ramulis parce puberula vel glabra, bracteis sub floribus lanceolatis circiter 2 mm longis caducis; pedicellis sub anthesi 15–20 mm longis superne incrassatis basim versus bibracteolatis, bracteolis mox caducis, ut calyce parce puberulis vel glabris; calyce sub anthesi 5–7 mm longo et apice diametro, tubo leviter apophysato in sicco ruguloso 2–3 mm longo, limbo erecto-patente papyraceo quam tubo longiore margine glandulas inconspicuas sessiles interdum gerente 5-dentato, dentibus deltoideo-apiculatis haud 0.5–1 mm longis, sinubus rotundatis vel complanatis; corolla tenuiter carnosa glabra cylindrica sub anthesi 18–21 mm longa et circiter 5 mm diametro, superne contracta, lobis 5 oblongo-deltoideis obtusis 2–2.5 mm longis; staminibus 10 alternatim valde inaequalibus, filamentis membranaceis alternatim 3–4 mm et 5–8 mm longis inferne in tubum connatis, longioribus distaliter gracilibus et ciliolatis vel puberulis, antheris 4–6 mm longis, tubulis thecas subaequantibus per rimas ovales 1–2 mm longas apertas dehiscentibus; stylo tereti corollam subaequante, stigmate minute peltato.

PERU: Huánuco: Carpish, crest between Huánuco and Tingo María, alt. 2800–2900 m,

February 6, 1950, *R. Ferreyra* 6709 (US 2057842 TYPE) (shrub about 1 m high, in evergreen woods; corolla red, the apex white); Loreto: Divisoria, Prov. de Coronel Portillo, alt. 1,500–1,600 m, *Ferreyra* 1671 (US) (shrub 2–5 m high, in tropical forest; corolla scarlet, white at apex); Junín: Huacapistana, alt. 1,700–1,800 m, *Sandeman*, June 1938 (K) (shrub in semishade on edge of rain-forest; corolla deep rose), *Sandeman* 4514 (K) (subshrub, in scrub on mountainside; corolla crimson), 4588 (K) (shrub on overhanging rock in gully, in semishade; corolla crimson); Agua Dulce, Prov. Tarma, alt. 2,000 m, *Woytkowski* 35482 (Ch, US) (shrub 4 m high, in forest; calyx red; corolla vermilion with white tip).

The cited specimens are not entirely identical, but there seems little doubt that they represent the same taxon, apparently localized in central Peru. The type has a fairly persistent indument on its branchlets, rachis, and pedicels, while the other specimens are essentially glabrous; *Ferreyra* 1671 has slightly smaller calyces than the other collections.

Orthaea ferreyrae is related to a group of three species of southern Peru and Bolivia, having flowers most similar to those of *O. pinnatinervia* Mansf., from which it differs in having its leaves with basally oriented, ascending secondaries, and in its elongate inflorescence, longer pedicels and calyx, more ample corolla, and stamens with much longer filaments and somewhat larger anthers. From *O. weberbaueri* Hoer., which it resembles in foliage, the new species differs in obvious floral characters, namely its longer pedicels, its calyx-limb without marginal thickenings and with rounded rather than acute sinuses, and its much larger stamens. As compared with *O. ignea* Sleumer, *O. ferreyrae* lacks the rufescent foliar indument and is further distinguished by its elongate inflorescence and larger flowers, especially as regards the pedicels, calyx, and filaments.

Satyria vargasii, sp. nov.

Frutex ad 2 m altus, ramulis subteretibus stramineis vel purpurascentibus apices versus 1–2.5 mm diametro et minute albido-puberulis demum glabratis; foliis pro genere parvis, petiolis subteretibus rugulosis 1–2 mm longis ut ramulis puberulis glabratisque, laminis in sicco subcoriaceis fusco-olivaceis glabris, ellipticis, 2–3 cm longis, 1.3–1.8 cm latis, basi rotundatis vel late obtusis, apice rotundatis, margine integris incrassatis leviter recurvatis, e basi 5- vel 7-nerviis, costa nervisque secundariis intimis adscendentibus supra prominulis subtus paullo elevatis, nervis secundariis inferioribus et rete venularum saepe immersis; inflorescentia 1- vel 2-flora basi bracteis paucis papyraceis deltoideis obtusis ad 1.5 mm longis ciliolatis caducis circumdata; pedicellis teretibus in sicco rugulosis sub anthesi ad 12 mm longis et calyce minute puberulis basim versus bibracteolatis, bracteolis lanceolatis acutis 1.5–2 mm longis; calyce sub anthesi circiter 4.5 mm longo et 5 mm apice diametro, tubo cupuliformi 1.5–2 mm longo, limbo papyraceo erecto-patente intus glabro profunde 5-lobato, lobis ovato-deltoideis apiculatis 2–2.5 mm longis, sinubus acutis; disco annulari-pulvinato glabro; corolla tenuiter carnosa cylindrica sub anthesi 10–12 mm longa et circiter 4 mm diametro extus minute puberula intus glabra, lobis 5 oblongis laud 1 mm longis; staminibus 10 leviter inaequalibus alternatim circiter 5.5 mm et 6 mm longis, filamentis membranaceis glabris in tubum circiter 2.5 mm longum connatis, antheris alternatim circiter 3.7 mm et 4.2 mm longis, thecis basi apiculatis incurvatis, tubulis longitudine thecas subaequantibus apice dilatatis per rimas ovales 1–1.5 mm longas dehiscentibus; stylo gracili tereti corollam subaequante.

PERU: Cusco: Prov. Paucartambo, between Sanamayo and Tambomayo, alt. 1360 m, May 4, 1947, *C. Vargas C.* 6493 (US 1997863 TYPE) (shrub about 2 m high, in open valley).

Although the plant here described is superficially suggestive of such small-leaved species of *Thibaudia* as *T. biflora* (Poepp. & Endl.) Hoer., its staminal characters make its assignment to *Satyria* imperative. Here, however, it has no close allies, being perhaps most nearly related to *S. polyantha* A. C. Sm., from which it is immediately distinguished by its much smaller leaves, its 1- or 2-flowered inflorescence, its conspicuously lobed calyx, and its comparatively large floral parts.

MYCOLOGY.—*Development of* Pythium debaryanum *on wet substratum.* CHARLES DRECHSLER, United States Department of Agriculture, Plant Industry Station, Beltsville, Md.

In a recent paper (Drechsler, 1952) on swarm-spore development from oospores of *Pythium ultimum* Trow (1901) and *P. debaryanum* Hesse (1874) the two fungi were compared with respect to the morphology of their sexual reproductive apparatus as displayed in Petri plate cultures prepared with moderately firm maizemeal agar. Comparison in such cultures was deemed appropriate since both fungi are widely operative as causal agents of damping-off, root rot, and stem rot in many phanerogamic crop plants and consequently are most often encountered by plant pathologists, by whom pathogenic microorganisms have long been studied on agar media. As the discussion and illustrations previously devoted to *P. debaryanum* covered its morphology only in part, some additional aspects of development disclosed by that species on wet substratum are given attention herein. Besides encouraging zoospore formation free liquid water makes for longer antheridial branches and narrower antheridia, so that sexual reproductive apparatus developed under wet conditions has a characteristic rangy appearance. To investigators of the aquatic microflora, who mostly have continued to study oomycetes in submerged or irrigated material, the rangier reproductive habit may even nowadays be more familiar than the somewhat compact habit usual in unwet substrata. The modifications resulting from aquatic conditions often appear here and there in Petri plate cultures, owing to condensation of water within the covered dishes in quantities sufficient to form shallow pools or wet areas on the agar surface. Sometimes, indeed, when Petri plate cultures are stored during periods of hot weather in a refrigerator equipped with an efficient temperature-control device the agar becomes wetted so extensively that indications of zoospore formation may be found almost everywhere.

The same isolation that was used in preparing the illustrations of *Pythium debaryanum* in my earlier paper (Drechsler, 1952, figs. 7, 8) was used also in illustrating development of the species on irrigated slabs of maizemeal agar (Figs. 1–3). Another isolation, one obtained in May, 1922, from a softened pea (*Pisum sativum* L.) root taken near Madison, Wisconsin, was employed in illustrating development on irrigated slabs of Lima-bean agar (Figs. 4, 5). When they were tried out at different times in the greenhouse the two isolations showed moderate capabilities for the destruction of seedlings. In wound-inoculation experiments with plant products like cucumber (*Cucumis sativus* L.), squash (*Cucurbita pepo* L.) and watermelon (*Citrullus vulgaris* Schrad.) fruits they likewise showed effectiveness as agents of rapid decay in more mature fleshy vegetable tissue.

A mycelium of *Pythium debaryanum* actively growing in a Petri plate of maizemeal agar often displays a branching habit generally similar to that of my *P. anandrum* (Drechsler, 1939, fig. 12), in that its long axial hyphae are rather markedly distinguished from the relatively short, somewhat closely ramified lateral branches borne on them. The same branching habit is frequently recognizable also in *P. mamillatum* Meurs (1928) and *P. spinosum* Sawada (1927), whereas in *P. ultimum* growth is more promiscuous, with the lateral branches more often elongating indeterminately much like the hyphae from which they originated. Later, when mycelium of *P. debaryanum* is being emptied of contents to provide material for the production of sporangia (Fig. 1, A, t) and oogonia, successive stages in progressive evacuation of all hyphal components are marked by deposition, usually at comparatively short intervals, of successive convex retaining walls (Fig. 1, A, a-s). The tubular membrane of the empty filaments often evanesce more rapidly than the cross-walls, with the result that the matted empty hyphae on the surface of agar plate cultures 10 to 15 days old are frequently visible under the microscope only by their innumerable curved septa. Aging Petri plate cultures of *P. mamillatum* and *P. spinosum* similarly may show many crescentic cross-walls within tubular membranes that have largely vanished from sight. In *P. ultimum* the matted aerial mycelium affords only a rather meager display of curved septa.

Hesse, working with water cultures, described

the zoosporangia of *Pythium debaryanum* as being formed terminally both on the lateral branches and on the main hyphae; and, indeed, terminal zoosporangia are produced abundantly on mycelium that has grown out from irrigated pieces of natural or artificial substratum. In agar plate cultures, however, zoosporangia of globose or prolate ellipsoidal shape are more often formed intercalarily (Fig. 2, A-E; Fig. 3, A-M; Fig. 4, E, a). Some sporangia develop close together on the same hypha (Fig. 2, F, a, b; Fig. 4, Y, a-c). Here and there remnants of protoplasm are gathered into cylindrical cells (Fig. 2, G, a, b; Fig. 3, N-P) which despite their unmodified shape are capable of serving as zoosporangia. When slabs excised from agar plate cultures 10 to 15 days old are placed in a shallow layer of water under cool conditions—I have used temperatures near 10° and 17° C.—some of the sporangia present will often in less than 1 or 2 hours put forth an evacuation tube (Fig. 2, H, t; Fig. 3, Q, t; Fig. 4, A, t) that soon forms a cap of dehiscense at its tip. This cap suddenly yields, and after the manner usual in the genus becomes inflated into a vesicle (Fig. 2, I, v) as it receives the protoplasmic materials discharged through the evacuation tube. Conversion of the protoplasm into laterally biciliate motile zoospores (Fig. 3, R, v Fig. 4, B, v) ensues in about 20 minutes. Normally the zoospores escape and swim away when the vesicle wall collapses under their collective battering, but where the supply of water is inadequate the whole zoospore progeny (Fig. 2, J, a-r) may encyst without moving from its place of origin.

The evacuation tube in *Pythium debaryanum* may arise from any position on the sporangium (Fig. 2, H-S:t; Fig. 3, Q-X: t; Fig. 4, A-Y: t). Its observed length in my cultures has varied from 2μ (Fig. 4, V, t) to 135μ (Fig. 3, U, t). Instances in which the tube is shorter than 5μ or longer than 50μ are, however, decidedly infrequent. Examples more than 100μ long (Fig. 3, T, t; U, t) were discovered only by prolonged search in material displaying many thousands of empty sporangia in positions favorable for unambiguous observation. Hesse's statement that the evacuation tube is longer than the radius and shorter than the diameter of the sporangium bearing it sets forth a dimensional relation that assuredly is frequent in the species.

Although zoospore development often begins soon after a slab excised from an agar plate culture has been transferred to water, only a small proportion of all the sporangia present will commonly participate in such development at the start. Swarm-spore formation usually continues for several days as more and more of the remaining sporangia, in apparently haphazard sequence, produce evacuation tubes and discharge their contents. After 2 or 3 days considerable numbers of zoospores, some in encysted condition (Fig. 3, Y, a-e; Fig. 4, Z, a-g), others in an actively germinating state (Fig. 3, Y, f), may be found strewn about. Here and there imperfect cleavage of discharged masses of protoplasm results in grouped encysted bodies (Fig. 3, Z, a-d) frequently larger than normal zoospores and often of irregular shape.

The sexual reproductive apparatus of *Pythium debaryanum* formed on wet or submerged substratum, much like that formed on unwet agar, may be of either monoclinous (Fig. 1, B-L; Fig. 5, A-L) or diclinous (Fig. 1, M; Fig. 5, M-O) origin. Often in monoclinous reproductive units a solitary male branch arising at some little distance from the oogonium supplies a single terminal antheridium (Fig. 1, B-K; Fig. 5, A-F), though occasionally it supplies 2 antheridia (Fig. 5, G, a, b). Frequently 2 male branches arise from the oogonial hypha, each supplying an antheridium (Fig. 5, H, a, b). In some instances, however, where 2 antheridia are present, only one is borne on a branch (Fig. 5, I, a), the other being composed of a hyphal segment immediately adjacent to the oogonium (Fig. 5, I, b). Sometimes where 3 antheridia are present 2 of them (Fig. 5, J, a, b; Fig. 5, K, a, b) may be borne on separate branches arising from the oogonial hypha either on the same side (Fig. 5, J) or on opposite sides (Fig. 5, K) of an intercalary oogonium, while the third may consist of a cylindrical hyphal segment (Fig. 5, J, c; K, c) adjacent to the oogonium. Further variety in positional relationships of the male cells is provided now and then in instances where an oogonium is supplied with 4 antheridia, 2 of them (Fig. 5, L, a, b) perchance borne terminally on separate branches, a third consisting of a sessile pouchlike outgrowth (Fig. 5, L, c) arising in immediate proximity to the oogonium, and a fourth composed of a hyphal segment (Fig. 5, L. d) adjacent to the oogonium. Fertilization of an oogonium solely by an antheridium composed of an adjacent hyphal segment is observable only somewhat rarely in *P. debaryanum* (Fig. 1, L),

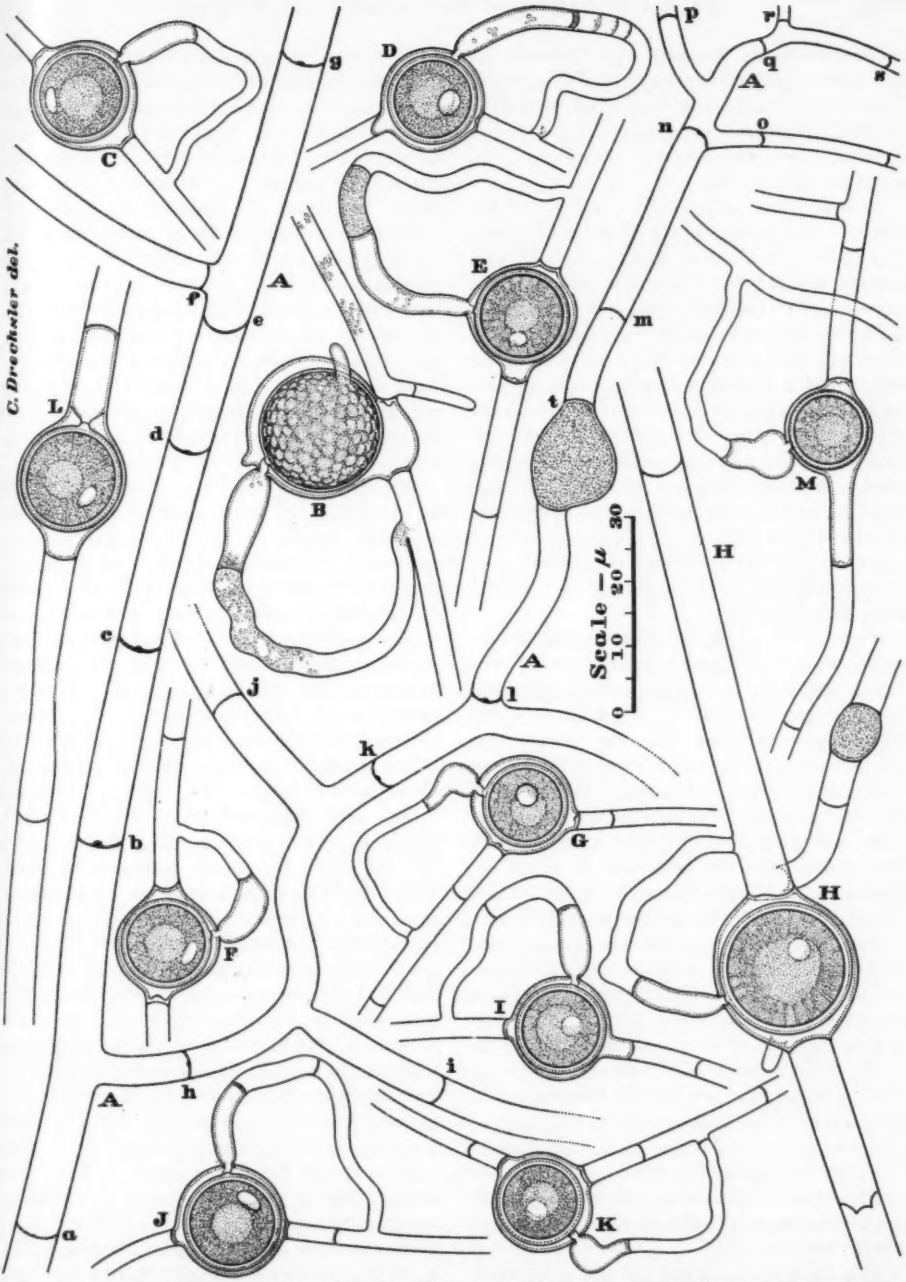

FIG. 1.—*Pythium debaryanum*, on wet maizemeal agar; × 1000. A, Empty mycelium with curved cross-walls, a-s, and a conidium, t. B-K, Units of monoclinous sexual apparatus, each with a single antheridium borne terminally on a branch. L, Monoclinous reproductive unit with antheridium consisting of a hyphal segment adjacent to oogonium. M, Diclinous reproductive unit. (Oospore young in B, nearly but not wholly mature in C, E-M.)

but is exceedingly frequent in *P. ultimum*. Indeed, such cylindrical antheridia as well as pouch-like sessile antheridia borne laterally in immediate proximity to oogonia are generally infrequent in *P. debaryanum*, and in many cultures are found only after some search.

Since for the most part the longer antheridial branches in monoclinous reproductive apparatus of *Pythium debaryanum* formed on wet substratum arise at no greater distance from the oogonium than the male branches in monoclinous apparatus formed in unwet agar cultures they necessarily follow more circuitous courses. In diclinous as in monoclinous reproductive apparatus the antheridia borne terminally on branches are commonly longer and narrower on wet substratum than in unwet agar cultures. A reciprocal relation between diclinous reproductive units comes to light in instances where two neighboring mycelial hypha (Fig. 5, O, a, b) each bear an oogonium (Fig. 5, O, c, d) that is fertilized by an antheridium (Fig. 5, O, e, f) borne on a branch given off by the other.

Hesse (1874, p. 25, line 2) described the oogonial envelope of *Pythium debaryanum* as being smooth and in his several illustrations pertaining to sexual reproduction the oogonium is shown without protuberances. It seems possible that only 4 individual oogonia are represented in these illustrations since 5 of his figures (Hesse, 1874, figs. 15–19) show such resemblances that they might well have been prepared at successively later stages from the same unit of sexual apparatus as his 2 figures (Hesse, 1874, figs. 13, 14) of earlier stages. In the fungus best conforming to Hesse's description smooth oogonia, as a rule, predominate strongly, yet if a considerable number of them are examined closely, scattered examples are usually found that bear one, two, or three protuberances (Fig. 1, B, H; Fig. 5, D, G, K). Mostly these protuberances are of cylindrical shape, and are broadly rounded at the tip like the fingers of a glove. Frequently they are only 2 or 3μ long, yet often, again, they measure 10 to 20μ in length. The shorter protuberances usually remain continuous with the oogonium, though the longer ones often become delimited by a basal septum.

This meager ornamentation might be disregarded but for the circumstance that isolations are often obtained which while closely resembling those with mostly smooth oogonia will rather commonly show digitations in sufficient numbers to be noticed even under cursory examination. The oogonia produced when such isolations are grown on Petri plates of maizemeal agar often vary markedly with respect to degree of ornamentation, some being devoid of protuberances, and others bearing 1 to 7 digitations in their upper and equatorial aspects. Throughout a culture the average number of protuberances exposed to view hardly ever seems much in excess of 3. In some cultures the same isolations appear very nearly smooth, with the oogonia there displaying, on the average, considerably less than one digitation apiece. Nevertheless the tendency toward development of protuberances in readily noticeable quantity apparently persists in these isolations over many years as an inherent character.

It is difficult to hold very strong convictions as to whether the isolations with this character represent merely a variant of *Pythium debaryanum* or a separate species. In the monographs of Matthews (1931) and Middleton (1943) *P. irregulare* Buisman (1927) is treated as a separate species with a circumscription that would evidently admit the noticeably digitate isolations under discussion and would exclude the nearly smooth isolations herein considered referable to *P. debaryanum*. This circumscription may not be strictly in agreement with the morphology of Buisman's fungus. Through the Centraal Bureau voor Schimmelcultures a culture of *P. irregulare* given by Buisman was supplied to me a few years after the species had been described. When the culture was transferred to maizemeal agar and Lima-bean agar the resulting sexual reproductive apparatus (Fig. 6, A-I) displayed few oogonial protuberances (Fig. 6, C, D), the degree of ornamentation observed not exceeding that usual in the relatively smooth isolations assigned to *P. debaryanum*. In the very numerous monoclinous reproductive units the antheridium was commonly borne on a branch arising some distance from the oogonium (Fig. 6, A-F). Where 2 antheridia were present in monoclinous units each was most frequently borne on a separate branch (Fig. 6, G, a, b), though in occasional instances one was borne on a branch (Fig. 6, H, a) while the other developed from a segment (Fig. 6, H, b) immediately adjacent to the oogonium. Buisman stated in her account that she never had seen hypogynal antheridia, yet after some little search in subcultures of her fungus a monoclinous reproductive unit was found in which the oogo-

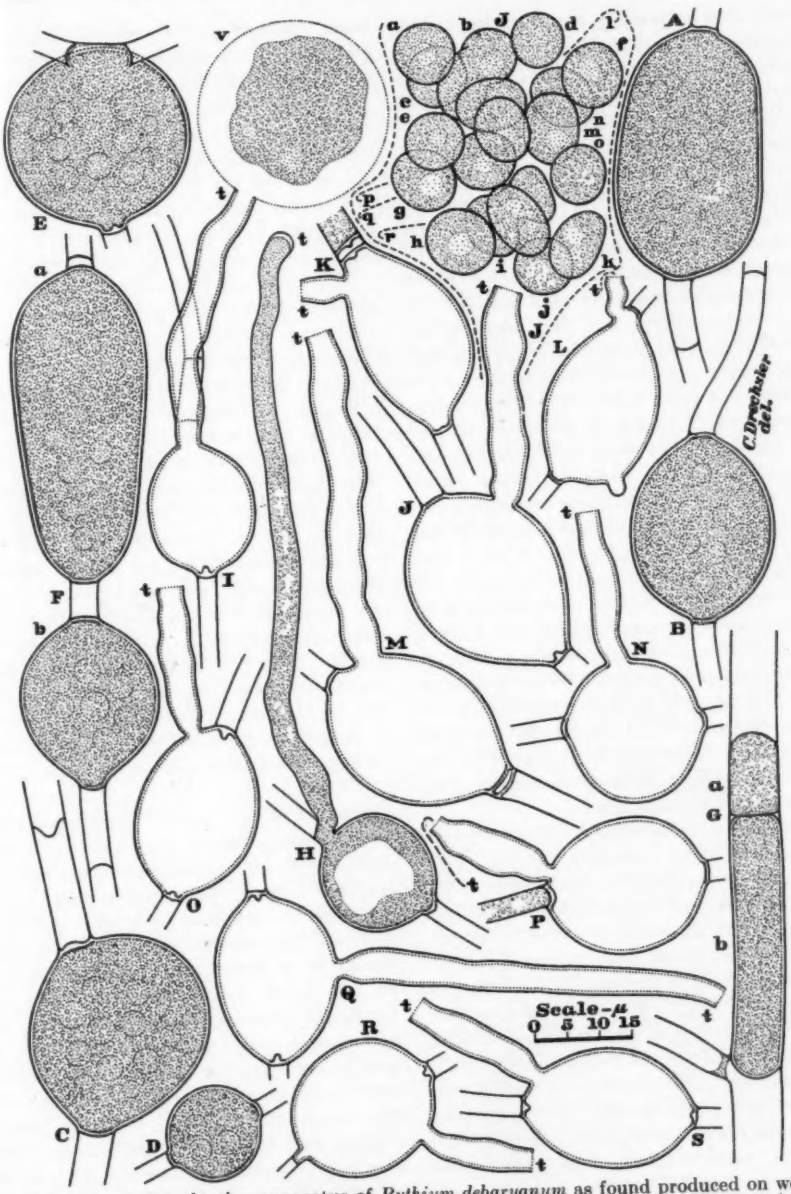

FIG. 2.—Asexual reproductive apparatus of *Pythium debaryanum* as found produced on wet maize-meal agar, drawn with the aid of a camera lucida at a uniform magnification; × 1000 throughout. A-E Intercalary zoosporangia. F, Two zoosporangia, a and b, formed near together. G, Two zoosporangia, a and b, formed in a wide hypha from remnants of protoplasm. H, Zoosporangium with unusually long evacuation tube, t, surmounted by hyaline cap. I, Newly discharged zoosporangium showing evacuation tube, t, with vesicle, v, at its tip. J, Discharged zoosporangium with its progeny of zoospores, a-r, encysted near mouth of its evacuation tube, t. K-S, Empty zoosporangia, each with its evacuation tube, t.

nium had been fertilized by 2 antheridia formed in immediate proximity to it, one consisting of an adjacent hyphal segment (Fig. 6, I, a), while the other, of pouch-like shape (Fig. 6, I, b), was sessile on the oogonial hypha.

Although Buisman distinguished *Pythium irregulare* from *P. debaryanum* mainly by the protuberances found on its oogonia, the 8 oogonia figured by her (Buisman, 1927, figs. 9, 10) show in all scarcely a dozen protrusions, and of these only 5 would seem of the digitate type. In some of her specimens the departures from a globose or ellipsoidal shape appear as if they might be attributable to collapse of portions of the oogonial envelope. Such collapse is considerably more pronounced in *P. debaryanum* than in *P. ultimum* since the oogonial envelope is noticeably thinner in the former species than in the latter, and consequently is more easily deformed either through mechanical disturbance or through loss of water. On the surface of agar cultures, where both *P. debaryanum* and *P. ultimum* often give rise to sexual apparatus most abundantly, the oogonial envelopes in mature reproductive units of *P. debaryanum* commonly show very marked deformation from collapse. As Buisman (1927, p. 10) apparently used no really efficient method for removing bacteria from her cultures it seems probable, besides, that at times the oogonia of her *P. irregulare* may have developed some of the promiscuous malformations often resulting from excessive bacterial contamination.

Buisman gave no descriptive details concerning either the three isolations she dealt with under the binomial *Pythium debaryanum* or the one isolation she identified as *P. debaryanum* var. *pelargonii* Braun. A statement given in her discussion of *P. irregulare* and reading "The antheridia are usually of the same type as those of *P. debaryanum*, but I never saw hypogynal antheridia" implies in its use of the adversative "but" that she recognized hypogynal antheridia as occurring in *P. debaryanum*, and thereby suggests that perhaps she applied Hesse's binomial to the species herein treated as *P. ultimum*. Such application, approximately, was urged some years later by Van Luijk (1934) in his proposal to adopt for *P. debaryanum* the circumscription set forth in De Bary's (1881a, 1881b) publications. Van Luijk believed this circumscription, which he intimated was supported by Butler, had governed usage until 1927 with complete satisfaction. He held that several faults in Hesse's paper discredited the original account of *P. debaryanum* so seriously that by itself it could not be regarded as providing a valid description. According to Van Luijk the faults in Hesse's account were rectified by De Bary in a characterization accurately portraying a fungus that can be found any day. In view of the imputed corrections the authorship of the species was broadened, so that the familiar binomial appeared as *P. debaryanum* Hesse em. De Bary.

Van Luijk regarded parasitism and the scope of asexual reproduction with respect to the presence or absence of zoospore development as being of no moment in distinguishing species; and he held it doubtful whether the differences in the antheridia of *Pythium debaryanum* and *P. ultimum* were sufficient to separate these two fungi. These views are largely contrary to my observations on the parasites under discussion. In my collection of cultures sameness or otherness has as a rule been indicated reliably by the capability of newly formed globose asexual reproductive bodies to produce zoospores and by the positional relation of the antheridium or antheridial branch in monoclinous sexual apparatus. The two features are most helpful, besides, in interpreting some of the early literature on the species sharing the particular kind of parasitism here in question, including the pertinent descriptive writings of Hesse, De Bary, and Trow.

These writings were all based on fungi obtained from seedlings that had succumbed to damping-off. Although this serious disease affects seedlings of many phanerogamic crop plants and is caused in rather considerable measure by species of *Pythium* the number of species effective enough in its causation to invite notice are few. In our middle and northern latitudes, where conditions of temperature and moisture during spring and early summer should not differ greatly from those in Alsace and Great Britain, the two species herein treated as *P. ultimum* and *P. debaryanum*, together with the somewhat digitate form treated by Matthews and Middleton as *P. irregulare*, are virtually the only damping-off parasites found which like the fungi described by Hesse, De Bary, and Trow give rise to relatively smooth oogonia and subglobose zoosporangia or conidia. Through this fortunate circumstance the few species mentioned are indicated rather definitely as the ones with which the writings of Hesse, De Bary, and Trow were

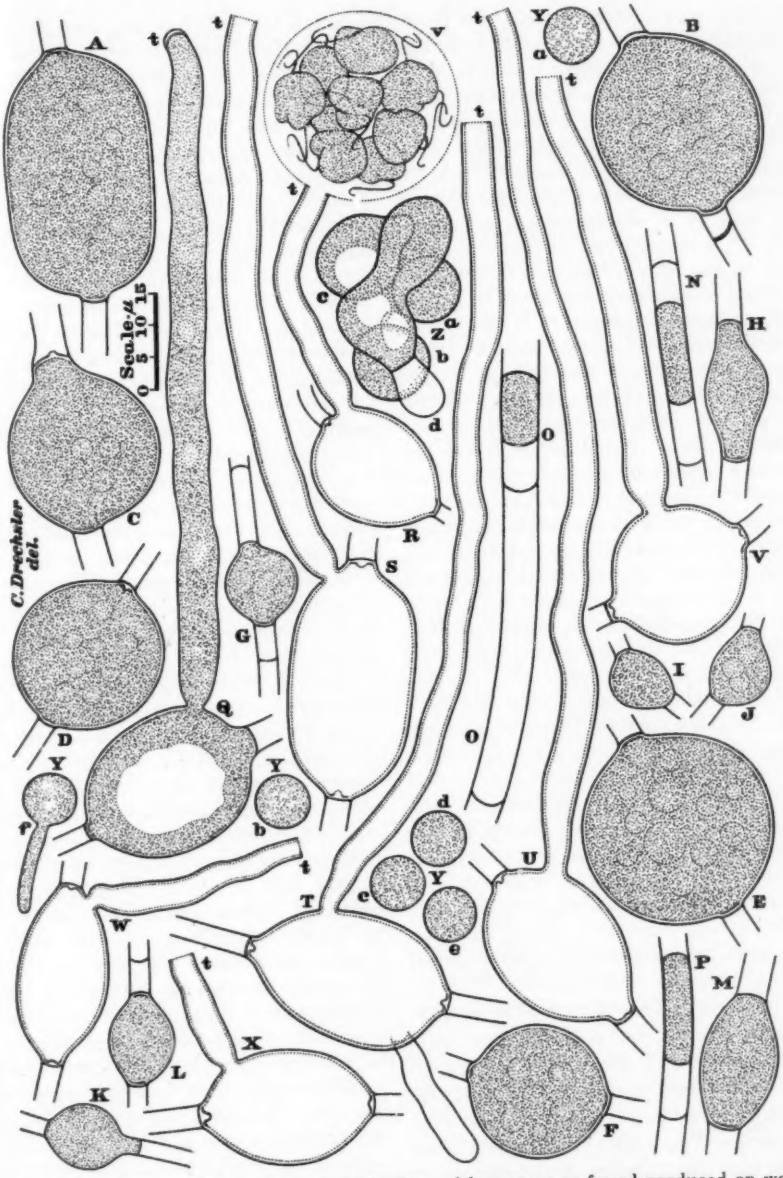

FIG. 3.—Asexual reproductive apparatus of *Pythium debaryanum* as found produced on wet maize-meal agar, drawn with the aid of a camera lucida at a uniform magnification; × 1000 throughout. A-M, Intercalary zoosporangia of various sizes and of globose or ellipsoidal shape. N-P, Small cylindrical zoosporangia formed in hyphae from remnants of protoplasm. Q, Zoosporangium with unusually long evacuation tube, t, surmounted by hyaline cap. R, Zoosporangium showing an evacuation tube, t, with a vesicle containing zoospores. S-V, Empty zoosporangia, each with an exceptionally long evacuation tube, t. W, X, Empty zoosporangia, each with an evacuation tube, t, of ordinary length. Y, Six encysted zoospores, a-f, of which one, f, is germinating. Z, Group of 4 encysted masses of protoplasm, a-d, resulting from frustrated development in discharged sporangial contents.

for the most part concerned. Thus De Bary's firsthand account of the damping-off fungus he considered to be *P. debaryanum* can be safely understood as relating unambiguously to a species found operating very widely and destructively as a causal agent of damping-off—to the species herein termed *P. ultimum*—though the morphology it sets forth would apply almost equally well to a closely related congeneric species, *P. paroecandrum* Drechsler (1940), which so far has come to light only as a cause of root rot and rootlet-tip discoloration. In Hesse's original and earlier description of *P. debaryanum* is set forth recognizably another parasitic species scarcely less widespread and efficient in the causation of damping-off than the one which De Bary presented under the same binomial. The differences whereby present-day isolations can be separated are detectable in the writings of the two pioneer investigators. Isolations in which very frequently the relatively smooth oogonium is fertilized by an antheridium borne terminally on a branch arising from the oogonial hypha at a distance from the oogonium about equal to the oogonial diameter—the relation of parts depicted by Hesse—will readily produce zoospores from zoosporangia of mycelial origin. On the other hand, damping-off isolations in which the oogonium is commonly fertilized by an antheridium consisting of an adjacent hyphal segment or of a lateral pouch-like cell arising in immediate proximity to the oogonium—the positional relationships most frequent in De Bary's illustrations—are decidedly reluctant to produce zoospores from conidia of mycelial origin, and yet will form them rather consistently from germinating after-ripened oospores or from sporangia borne on germ hyphae extended by after-ripened oospores. It is hardly surprising that De Bary, though a master of unsurpassed proficiency, found zoospores to be produced sparingly, whereas Hesse with only the limited experience of a student would seem to have obtained zoospores abundantly during the first few weeks he worked with his fungus. Van Luijk's success in obtaining zoospores from the isolations he referred to *P. debaryanum* Hesse em. De Bary may have been due primarily to his use of material from an old dried-up pure culture, for in such a culture the oospores present would ordinarily have had ample time to undergo the changes of after-ripening. If, as seems probable, the isolations were referable to *P. ultimum* they need not have been of exceptional reproductive behavior like the cultures that Ark and Middleton (1949) observed giving rise to zoospores from ordinary conidia.

In his text Hesse gave no measurements for the hyphae and reproductive bodies of *Pythium debaryanum*. Apparently he relied entirely on his illustrations to convey metric information. Unfortunately, at the magnifications given in the legends his figures show excessive approximate values for all dimensions: 13μ for width of a main mycelial filament; 45μ for diameter of zoosporangium; 20 to 23μ for diameter of encysted zoospores; 75μ and 50μ for length and width, respectively, of an intercalary conidium; 45 to 48μ for diameter of oogonium; 37μ and 10μ for length and width, respectively, of an antheridium; and 37μ for diameter of oospore. Since in any of the damping-off species—and the damping-off species are among the coarsest members of the genus—13μ is about twice the usual width of an elongating axial hypha a few hundred microns from its tip, the actual magnification would seem about twice that given in the legend. Indeed, if the magnifications given in all the legends were doubled the smaller dimensional values then derived from the figures would be in tolerably good agreement with the usual measurements for either of the damping-off fungi under discussion, which except for differences in thickness of oospore wall and in length of monoclinous antheridial branches are, in general, of nearly equal size. How the error might have come about is conjectural. It may perhaps be no mere coincidence that on the two folded plates of the published dissertation Hesse's figures occupy rectangular areas about twice the width of the printed pages. Should the procedure for making lithographs 80 years ago have readily permitted reproduction of illustrations at reduced sizes the magnifications appearing in the legends might have been given in the expectation that the plates would be adjusted to the width of the page. In any case, the error, though most unfortunate in the original account of a species which with respect to its binomial has become one of the most familiar of all fungi, is so very obvious that it should not occasion any serious misunderstanding as to what damping-off parasite was the main subject of Hesse's description.

In sexual apparatus of *Pythium debaryanum* produced on wet or unwet agar substratum the antheridia borne terminally on branches are

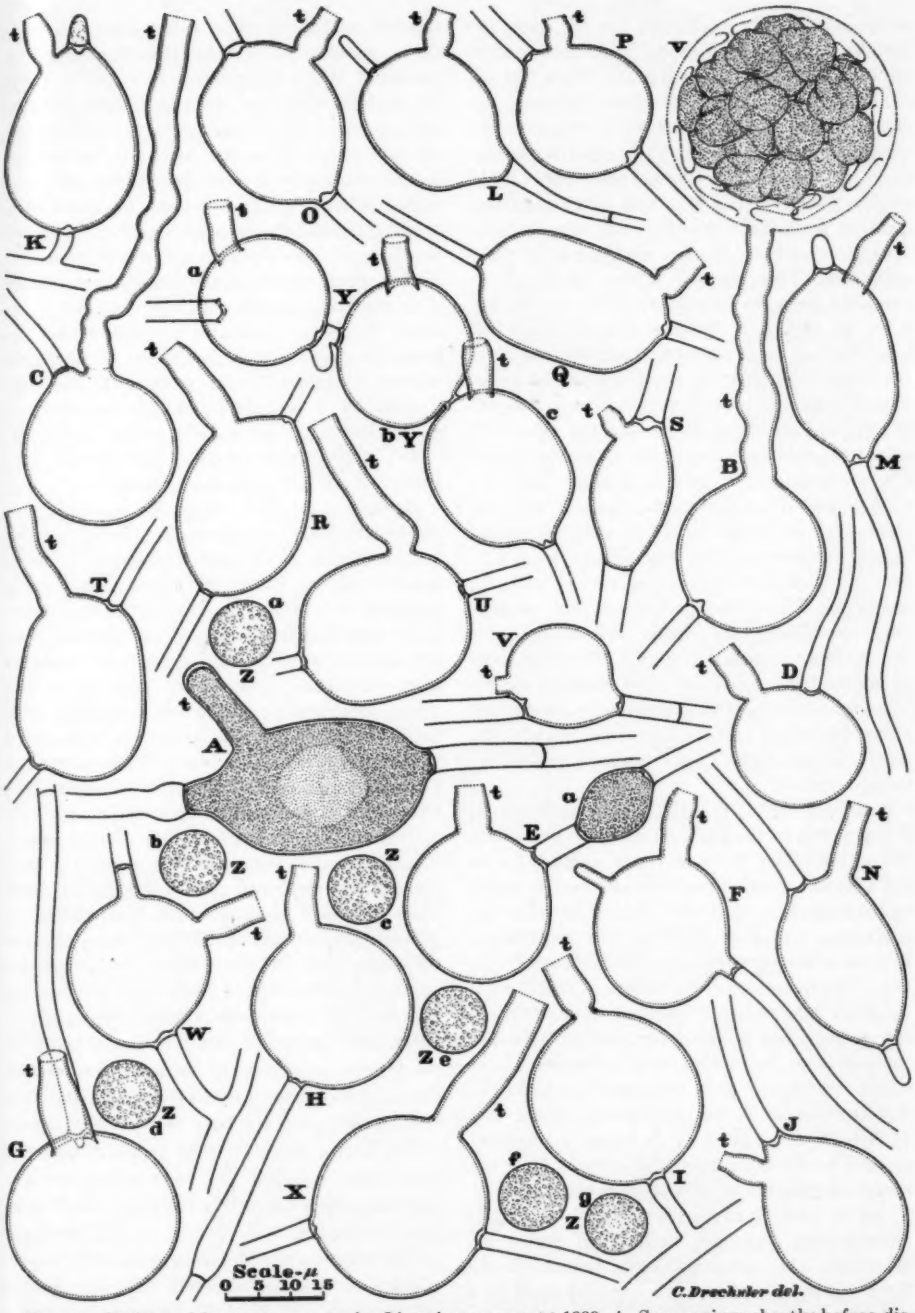

FIG. 4.—*Pythium debaryanum*, on moist Lima-bean agar; × 1000. A, Sporangium shortly before discharge. B, Sporangium with active zoospores in vesicle, v. C-J, Empty terminal sporangia. E, a, K-X, Empty intercalary sporangia. Y Three empty sporangia, a-c, close together. Z, Encysted zoospores, a-g. (A-Y: t, evacuation tube.)

rather consistently applied to the oogonium by their tips. However in sexual apparatus formed on extramatrical submerged mycelium, terminally borne male cells are often observable in more varied postures. Postural relations infrequent in agar cultures are shown in the illustrations not only of early workers like Hesse (1874) and Sadebeck (1875), who had only submersed material available for study, but also of later workers who have studied such material from preference. Thus, several of the figures of *P. irregulare* given by Matthews (1931, pl. 24, fig. 4; pl. 25, figs. 1, 3, 9) show antheridia applied laterally, and in at least two instances the male cell seems intimately in contact with the oogonium throughout its length (Matthews 1931, pl. 25, fig. 3, upper; fig. 9). In the few figures of sexual reproductive apparatus given by Hesse the antheridium is shown applied laterally, though the area of contact is rather well forward and of either small or only moderate extent. Hesse's text does not mention what portion of the antheridium makes contact with the oogonium, his most directly relevant phrases (sich dieser innig anschmiegt; das Anlegen des Pollinodiums; lagert sich an die Membran; dem Momente ihres Anlegens; durch Anlegen an die Membran des Oogoniums) not specifying directly either lateral or apical application, even if the word "anschmiegt" might connote rather extensive contact.

Sadebeck (1875, p. 124) in discussing sexual development in his *Pythium equiseti* stated that the antheridium is most often applied by its tip, that sometimes it becomes attached laterally to the oogonium, that very often it enwraps the oogonium, and that therefore the fertilization tube is extended either apically or laterally. In one of the figures given by Sadebeck (1875, pl. 4, fig. 3) a longitudinally applied antheridium is shown extending a lateral fertilization tube into the oogonium. In another figure of Sadebeck's, in which are shown two connected monoclinous reproductive units, the antheridium in one unit (Sadebeck, 1875, pl. 3, fig. 8, right) is narrowly applied to the oogonium with its tip, while the antheridium in the other unit (Sadebeck, 1875, pl. 3, fig. 8, left), is applied lengthwise, so that it enwraps the oogonium closely and rather extensively. The circuitous male branch in the former unit arises from the oogonial stalk at a distance from the oogonium about equal to the width of that organ. The male branch in the latter unit arises from the same hypha as the oogonial stalk, its origin being separated from the oogonium by hyphal elements having a combined length approximately equal to twice the oogonial diameter. None of Sadebeck's illustrations show any antheridium formed in immediate proximity to the oogonium, and in his text the antheridia in monoclinous units are, with regard to their hyphal relations, discussed only as being borne terminally on branches. As might be expected from the arrangement of its monoclinous sexual apparatus the fungus several times gave rise to zoospores following transfer of infected *Equisetum* prothallia to water. Since infected prothallia always disintegrated completely without leaving any visible residue, the host substratum used by Sadebeck for swarm-spore production must have been rather newly invaded, and thus presumably should not have contained any after-ripened oospores.

Because of its ready parasitism on many host plants De Bary considered it likely that his fungus might have been observed by other workers besides Hesse. He stated that the description of *Pythium equiseti* left scarcely any doubt that Sadebeck's fungus was identical with the one he and Hesse had studied. All doubt as to the presumed identity was dispelled for him when some healthy *Equisetum* prothallia, after being inoculated with his fungus, were destroyed "murderously" in a few days. Without the advantages provided in collections of pure cultures—advantages accruing from opportunity not only to examine isolations wholly free of alien organisms but also to compare with respect to morphology, development, and pathogenicity isolations obtained from different host plants, in different regions, and at different times—it is not surprising that De Bary failed to uncover the correlated differences in antheridial morphology and zoospore production whereby the damping-off parasite figured by him is distinguished from the fungus corresponding better to the descriptions and illustrations of Hesse and Sadebeck. The latter fungus may well have been present in some of De Bary's material, since he mentioned (De Bary, 1881 b, p. 526) that in some cultures zoosporangia were formed in relatively large numbers, intermixed with resting conidia produced at the same time and under apparently similar conditions. Besides, unless he had seen Hesse's species now and then in his own material it appears unlikely that he would so readily have noted in the description and figures of *P. equiseti*

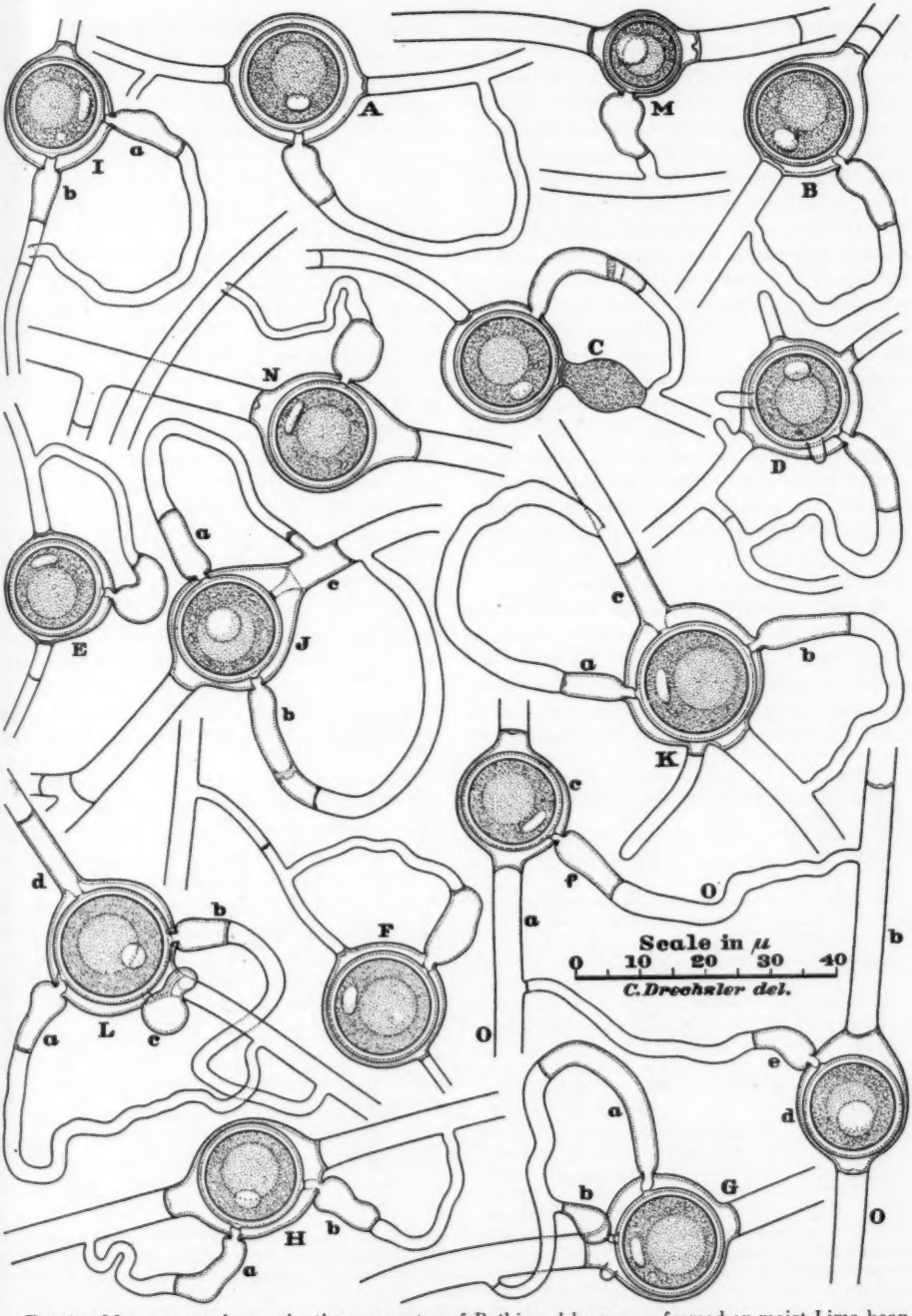

FIG. 5.—Mature sexual reproductive apparatus of *Pythium debaryanum* formed on moist Lima-bean agar; × 1000. A-F, Monoclinous units with single antheridia. G-I, Monoclinous units with 2 antheridia, a and b. J, K, Monoclinous units with 3 antheridia, a-c. L, Monoclinous unit with 4 antheridia, a-d. M, N, Diclinous units. O, Two connected diclinous units: a, b, parent hyphae; c, d, oogonia; e, f, antheridia.

any very persuasive similarity to the damping-off parasite depicted in his illustrations. His ready acceptance of Sadebeck's account would seem to imply that lateral fertilization tubes and laterally applied antheridia—even clasping antheridia—were not regarded by him as features incongruous with the morphology of *P. debaryanum*. It appears probable therefore that De Bary considered the treatment of antheridial morphology in Hesse's dissertation less as being wrong and requiring correction than as being insufficient and requiring amplification. Unhappily the amplification he provided would seem to have been derived for the most part, if not wholly, from a closely related species with similar parasitic tendencies.

Corroboration of Hesse's illustrations showing laterally applied antheridia and lateral fertilization tubes has come mainly from studies carried out on submerged material in water cultures. The positional instability usual in such cultures and the ease with which the more delicate submerged parts may be pushed out of place or pressed out of shape are not to be disregarded.

In Butler's (1907) monograph the treatment of the sexual reproductive stage in *Pythium debaryanum* conforms closely to De Bary's account. Butler's relevant firsthand observations then were limited to material obtained by causing cress seedlings to damp off at Freiburg im Breisgau, Germany. Although he found conidia and oospores produced abundantly, he saw no sporangia. His failure to obtain zoospores, together with his description of antheridia in the species as "from the same or another hypha as the oogonium, often formed close below the latter, and not seldom hypogynal," suggests strongly that the Freiburg fungus was the same as the one figured by De Bary.

A later paper published by Butler (1913) on *Pythium debaryanum* presents a firsthand account of a conspicuously different fungus he found at Pusa, India, in the caruncle of castor (*Ricinus communis* L.) seed that after being sown in pots of unsterilized soil had failed to germinate. In this fungus Butler did not observe any antheridia that consisted individually of a cylindrical hyphal segment adjacent to the oogonium. Often the antheridium was borne terminally on a branch arising from the oogonial hypha at some distance from the oogonium, the distance in six monoclinous reproductive units pictured (Butler 1913, figs. 1–4) ranging from about 10μ to 60μ. Above the junction of the two sexual stalks the female stalk was often longer than the male stalk and consequently was often curved. The resulting postural relation manifestly was the reverse of that shown in the sexual reproductive unit figured by Hesse, where the

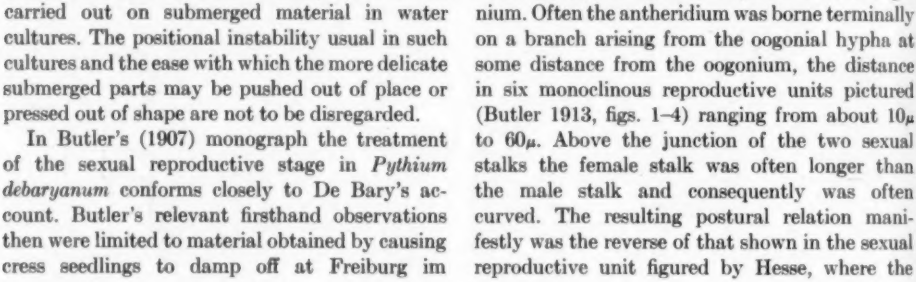

FIG. 6.—Mature sexual reproductive apparatus formed on moist Lima-bean agar inoculated with Buisman's isolation of *Pythium irregulare*, × 1000. A-E, Monoclinous reproductive units, each with a single antheridium. F, Monoclinous reproductive unit with a terminal antheridium bearing a lateral protuberance by which it is attached to the oogonium. G, Monoclinous reproductive unit with 2 antheridia, each borne terminally on a branch. H, Monoclinous reproductive unit with one antheridium, a, borne terminally on a branch, and another, b, formed in immediate proximity to the oogonium. I, Monoclinous reproductive unit with 2 antheridia, of which one, a, consists of a hyphal segment adjacent to the oogonium, while the other, b, is laterally sessile in immediate proximity to the oogonium.

straight oogonial stalk is shorter than the longer curving antheridial branch; and assuredly was the reverse of the postural relation most usual in monoclinous reproductive apparatus of the damping-off parasite herein treated under Hesse's binomial. Similar curvature of the oogonial stalk is found rather often in cultures of *P. butleri* Subr. and *P. aphanidermatum* (Eds.) Fitzp. (= *P. deliense* Meurs), and is conspicuous in Butler's (1907, pl. 2, figs. 3, 5, 6) illustrations of his *P. indigoferae*. Although the text contains no comment on the shape of the antheridium, all eight of the antheridia figured show a distinctive outward form in that they consist of a somewhat enlarged clavate terminal part together with a lateral protrusion by which they are united to the oogonium. Antheridia of approximately such design are found somewhat infrequently in *P. debaryanum* (Fig. 6, F) but are very numerous in *P. butleri* and *P. aphanidermatum*. It is not known whether the curious resemblance between the Indian fungus and *P. aphanidermatum* with respect to the make-up of their sexual apparatus may have had some influence in leading Jochems (1927) to identify provisionally as *P. debaryanum* the stem-burn parasite that Meurs (1934) later described under the binomial *P. deliense*. Apart from its production of zoospores from globose rather than from lobulate zoosporangia the Indian fungus with its relatively delicate mycelium appears clearly alien to Hesse's damping-off parasite, as well as to the other widely distributed damping-off parasite herein discussed, which after being set forth firsthand by De Bary was not described under a separate binomial of unambiguous application until Trow (1901) presented it somewhat mistakenly (Drechsler, 1935) as a new saprophytic species, *P. ultimum*. No species corresponding to the first-hand description and illustrations given by Butler has ever come to light among the cultures I have isolated from diseased plants and other materials. Since the Indian fungus was found in a locality where as high a temperature prevails as is ordinarily found in the tropics, its distribution may well be restricted to regions considerably warmer than central Maryland.

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ENTOMOLOGY.—*New species of Olethreutidae from Illinois (Lepidoptera).* J. F. GATES CLARKE, U. S. Bureau of Entomology and Plant Quarantine.

This paper is devoted to the description of species of olethreutid moths collected by Murray O. Glenn, of Henry, Ill. Only six species are treated here, although many more, chiefly represented by uniques, are in hand. Mr. Glenn deserves great credit for contributing so much to our knowledge of host associations and of the Microlepidoptera of the region. The photographs of the moths' wings were taken by Robert Bonde, U. S. Department of Agriculture. The drawings are by the author. Types of all the species are deposited in the U. S. National Museum, and paratypes are deposited in the National Museum and in Mr. Glenn's collection.

Eucosma uta, n. sp.
Figs. 1, 1a, 1b

Alar expanse, 20–22 mm.

Labial palpus with second segment very light buff, sprinkled with a few grayish scales; third segment very short, dark gray, buff-tipped. Head ochraceous-buff, face buff. Antenna ochraceous-buff with fuscous spot above on some segments; scape fuscous above. Thorax and forewing light buff; thorax strongly overlaid with fuscous and ochraceous-buff almost to the complete suppression of the ground color; apex of tegula light buff; basal two-fifths of forewing fuscous, except costal third, with considerable olivaceous scaling on basal angle; from slightly before middle of costa an outwardly slanting fuscous fascia extending to and broadening at tornus is preceded and followed by olivaceous; entire costa strigulated with short alternating pale buff and fuscous dashes, the former with a faint metallic luster; costal fold of male extending slightly beyond basal third; in terminal third, and in the dark fascia, several narrow metallic streaks; ocelloid patch obsolete, mainly indicated by two, short, metallic bars and a pair of faintly indicated longitudinal, black lines; cilia olivaceous strongly irrorate with blackish-fuscous basally. Hind wing fuscous; cilia buff with a grayish subbasal line, except in area of basal angle where they are almost wholly grayish. Legs buff overlaid and banded with fuscous. Abdomen buff below, fuscous above.

Male genitalia.—Harpe as figured. Uncus prominent, broad, rounded apically. Socii moderately long, fleshy, pendant.

Female genitalia.—Ovipositor with an anterior, ventral, prominent, evaginated opening. Remainder of genitalia as figured.

Type.—U.S.N.M. no. 61481.

Type locality.—Putnam County, Ill. (July 10, 1939).

Food plant.—Unknown.

Remarks.—Described from the type male and two female paratypes all from the same locality. The females are dated "13. viii. 45" and "5. viii. 47."

The nearest relative of *uta* appears to be *E. atomosana* (Walsingham), from which it differs by the presence of the dark basal patch and the absence of the white costal area and the semimetallic spotting of the forewing. In genitalia *uta* differs from *atomosana* by the evenly rounded uncus, more slender socii, and broader neck of harpe. No females of *atomosana* are available for a comparison of the genitalia.

Epiblema naoma, n. sp.
Figs. 2, 2a, 2b

Alar expanse, 14–18 mm.

Labial palpus with second segment buff, outwardly marked with grayish fuscous; third segment fuscous, buff-tipped. Antenna grayish fuscous with paler, narrow annulations. Head with admixture of buff and fuscous, varying greatly in different specimens, some with the lighter color absent. Thorax marked with three pairs of alternating dark and light transverse bands; in some specimens the dark bands are blackish fuscous and the light bands vary from buff to pale vinaceous. Forewing blackish fuscous; outer margin of basal patch outwardly oblique from costa to middle of wing then straight to dorsum; basal patch followed by a pale transverse shade from dorsum to costa, broader on dorsum; this pale shade varies from buff to pale vinaceous, being more pronounced in the males, and is followed by an outwardly oblique, narrow bar of the ground color; this in turn is followed by a pale terminal portion of the wing; slightly before apex a transverse dash of the ground color, frequently interrupted by pale scaling, extends to vein 5; costa marked for its entire length with alternating light and dark spots; costal fold of male extending to middle of costa; terminal half

of wing marked with dull leaden-metallic scales; cilia dull leaden-metallic preceded by a fine, dark subbasal line. Hind wing pale to dark fuscous with base, in males, almost white; cilia light fuscous with darker subbasal line. Legs buff to pale vinaceous the ground color mostly obscured by fuscous suffusion and banding. Abdomen consisting of alternating dark and light bands the extent of each varying with the specimen.

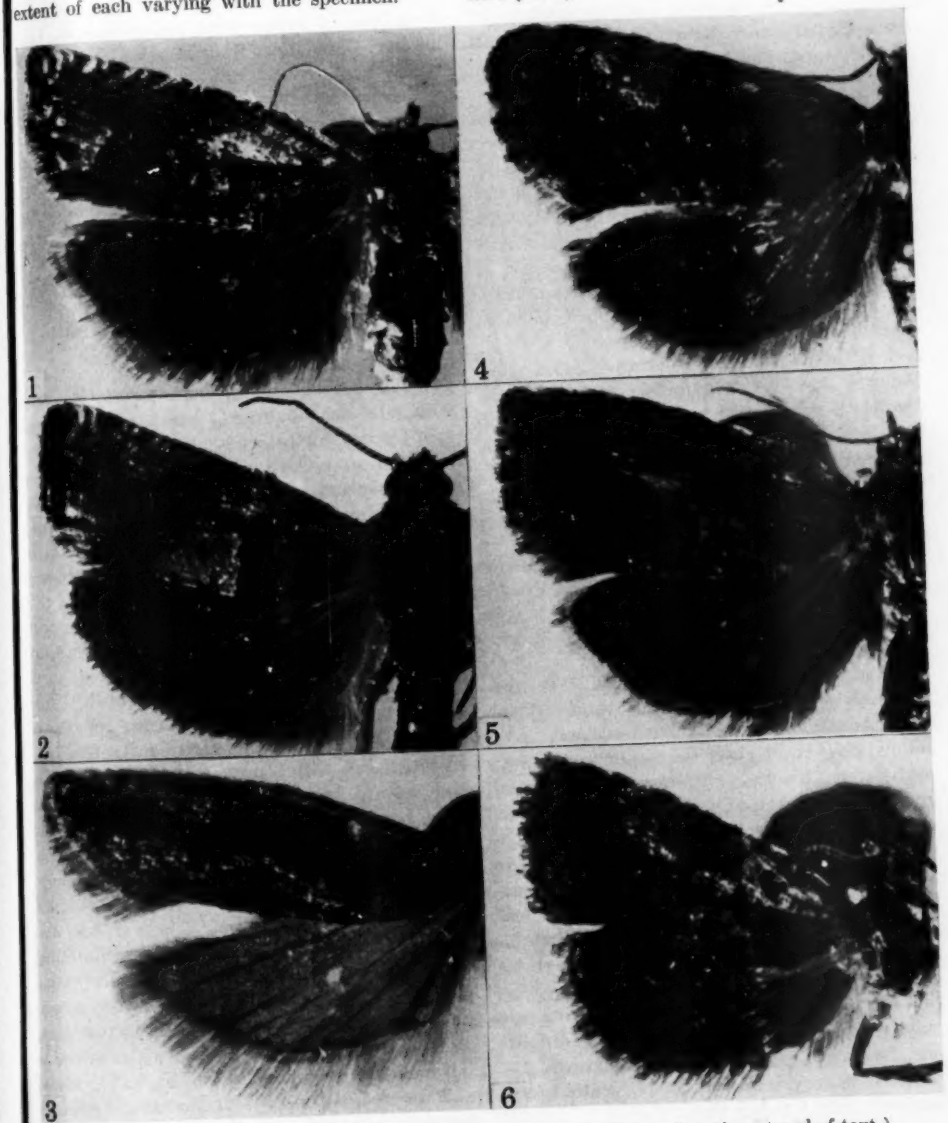
Male genitalia.—Harpe as figured. Uncus bilobed. Clasper strong, sharply pointed.

Female genitalia.—Ovipositor not shown; remainder as figured.

Type.—U.S.N.M. no. 61482.

Type locality.—Putnam County, Ill. (June 25, 1950).

Food plant.—*Ratibida pinnata* (Vent.) Barnhart (roots).



FIGS. 1–6.—New Olethreutidae from Illinois: Left wings. (See explanation at end of text.)

Remarks.—Described from the type male and 8 male and 9 female paratypes all from the type locality. Dates of emergence range from April 28 to June 25 (1948–1950).

As indicated in the description, *naoma* is an extremely variable species, difficult to describe. The wings figured represent an average male, but many of these exhibit much more light scaling. In the females the markings are usually more pronounced and clear-cut, and the majority of them appear much darker than the males. In general appearance and genitalia this species is nearest *E. iowana* McDunnough.

T. N. Freeman, of the Canadian National Museum, has kindly compared some of the specimens of *naoma* with McDunnough's type of *iowana* and remarks as follows: *E. iowana* has "apex of uncus truncate; ventral edge of sacculus strongly arcuate; neck of harpe much deeper excavated ventrally so that the ventral part of the cucullus projects well beyond; juxta arcuate dorsally." *E. naoma* has "apex of uncus bilobed; ventral edge of sacculus less strongly arcuate; neck of harpe shallowly excavated; juxta more truncate dorsally." He further states that in *iowana* "outer edge of basal band runs straight to radius then obtusely angled to costa" while in *naoma* "outer edge of the basal band is irregular and bends in the middle of the wing. Maculation is more distinct and the hind wings are whiter at base, otherwise quite similar."

Epinotia atristriga, n. sp.

Figs. 3, 3a, 3b

Alar expanse, 13–19 mm.

Labial palpus sordid whitish suffused with gray exteriorly on second segment; third segment gray. Antenna dark gray with narrow, paler annulations. Head gray, the scales tipped with sordid white. Thorax and forewing ground color gray with scales tipped with sordid white; tegula with black spot at base; forewing with longitudinal, median, irregular black streak for entire length; on each side of the median streak, particularly dorsally, sordid-white scaling; costal fold of male extending to basal two-fifths and containing expansible, whitish hair pencil; outer three-fifths of costa with some obscure dark spots; cilia gray with dark subbasal line. Hind wing pale grayish-fuscous; cilia lighter with dark subbasal line. Legs dark gray with pale annulations. Abdomen dark gray, somewhat lighter ventrally and anal tuft with ocherous tint.

Male genitalia.—Harpe as figured. Uncus long, curved, bifid. Socii long, narrow, dilated distally.

Female genitalia.— Ovipositor not shown, remainder as figured.

Type.—U.S.N.M. no. 61483.

Type locality.—Putnam County, Ill. (March 17, 1945).

Food plant.—Unknown.

Remarks.—Described from the type male and 14 male and 6 female paratypes all from the type locality. Dates range from March 17 to April 12 (1938–1946).

Formerly confused with *E. vertumnana* (Zeller), to which it is closely related, but differing from it by the uninterrupted dark median streak and much less white scaling dorsally on forewing. The chief differences in the male genitalia are the much broader base of sacculus and narrower, longer spine cluster of *vertumnana*.

Polychrosis sambuci, n. sp.

Figs. 4, 4a, 4b

Alar expanse, 10–13 mm.

Labial palpus pinkish buff; second segment with indistinct subterminal fascia and small basal spot fuscous. Antenna fuscous with paler annulations. Head pinkish buff shading to brownish posteriorly and with a fuscous spot on each side. Thorax cinnamon-buff; posterior tuft cinnamon; base of tegula and median transverse fascia fuscous. Forewing with basal two-fifths leaden-metallic the basal patch almost obliterated by this color and only indicated by a fine blackish-fuscous transverse line near base and another, outwardly curved fascia of the same color at one-fourth nearly obscured by cinnamon-buff scales; from slightly before middle of costa to middle of dorsum an outwardly curved, irregular, blackish-fuscous fascia with a prominent tooth extending well toward termen; dorsal half of this fascia largely overlaid with cinnamon-buff; on tornus a blackish-fuscous spot, overlaid with cinnamon-buff, and bordered by an inverted V-shaped leaden-metallic mark; between this and a smaller, similarly colored apical spot, a large blotch, also similarly colored, covers most of the subterminal area; on apical half of costa several alternating dark and light dashes; cilia mostly leaden-metallic with some cinnamon buff in tornal area. Hind wing fuscous; cilia grayish with dark subterminal line. Legs buff to pinkish buff overlaid and banded with blackish fuscous. Abdomen fuscous above, buff beneath.

Male genitalia.—Harpe as figured. Uncus broad, rounded. Socii small pads with long, coarse setae. Aedeagus slender, with curved distal end and single lateral tooth.

Female genitalia.—Ovipositor not shown; remainder as figured.

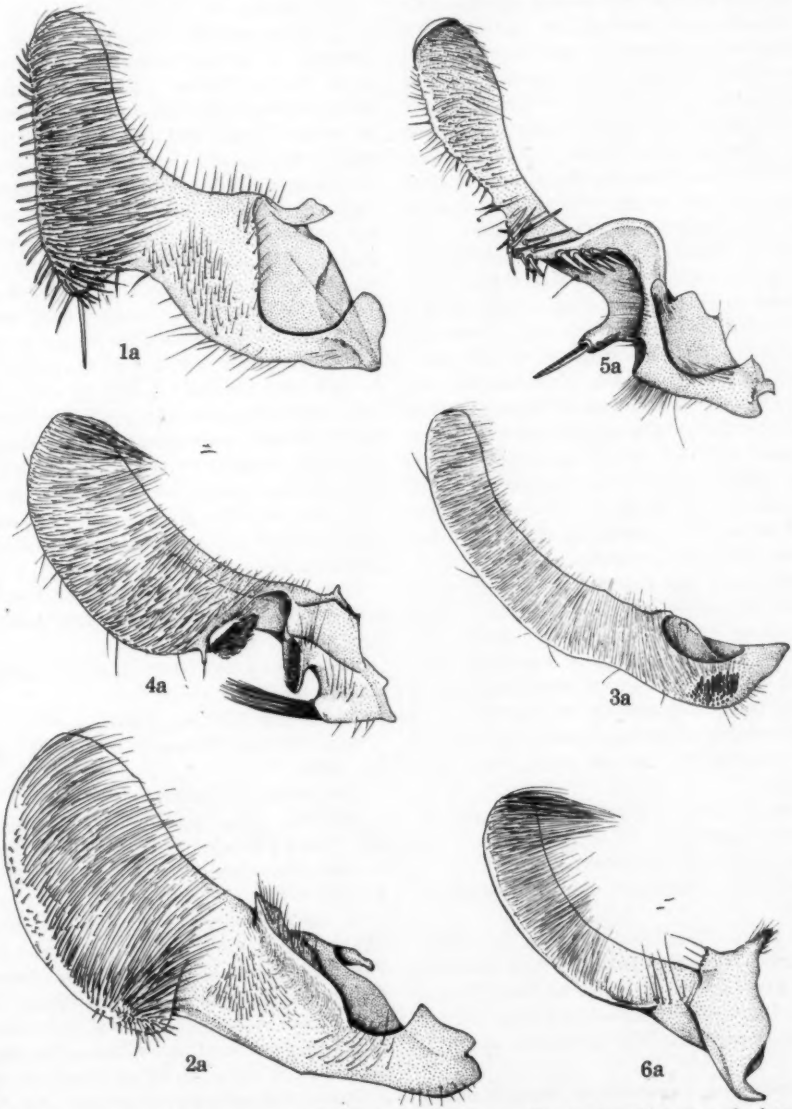
Type.—U.S.N.M. no. 61486.

Type locality.—Putnam County, Ill. (July 3, 1943).

Food plant.—*Sambucus canadensis* L.

Remarks.—Described from the type male and 5 male and 8 female paratypes all from the type locality. The dates range from May 20 to September 4 (1939–1949).

This species is difficult to distinguish from *P. monotropana* Heinrich on color and markings except that in *monotropana* the dark markings are clearer and the leaden scaling is smoother.



FIGS. 1a–6a.—New Olethreutidae from Illinois: Left harpes. (See explanation at end of text.)

The genitalia immediately distinguish the two. The aedeagus of *monotropana* is smooth, that of *sambuci* is armed with a single tooth. The fluted genital plate of *sambuci* immediately separates it from *monotropana*.

Exartema comandranum, n. sp.
Figs. 5, 5a, 5b

Alar expanse, 15–18 mm.

Labial palpus pale buff; second segment with small fuscous spot exteriorly at base and with smoky suffusion exteriorly at apex; third segment almost wholly overlaid with fuscous. Antenna blackish fuscous overlaid with olivaceous almost entire length above. Head fuscous with some tawny scaling in front. Thorax and basal three-fifths of forewing olivaceous, the latter with some admixture of buff; tegula with suffused fuscous spot at base; posterior tuft of thorax dark vinaceous-tawny; basal patch almost obscured by the olivaceous scaling and reduced to an oblique mark from basal angle to slightly before middle of cell; outer two-fifths of forewing dark vinaceous-tawny crossed by several irregular leaden-metallic lines; from middle of costa a short, wedge-shaped, outwardly oblique, blackish-fuscous dash, the dark color almost obscured by vinaceous-tawny scales; on tornus a similarly colored spot; from vein 8, slightly beyond end of cell, to termen at vein 5, an oblique bar of the same color; entire costa marked with short, alternating dark and light strigulae; cilia leaden-metallic mixed with dark vinaceous tawny and fuscous and preceded by a fine blackish-fuscous and tawny line. Hind wing light mummy brown; cilia fuscous mixed with buff with a dark subbasal line. Legs buff overlaid and banded with fuscous. Abdomen fuscous this color nearly obscured by buff beneath.

Male genitalia.—Harpe as figured. Uncus broad basally, tapering to a slender point. Socii small oval pads.

Female genitalia.—Ovipositor not shown; remainder as figured.

Type.—U.S.N.M. no. 61484.

Type locality.—Putnam County, Ill. (June 11, 1942).

Food plant.—*Comandra umbellata* (L.) Nutt.

Remarks.—Described from the type male and 12 male and 4 female paratypes all from the type locality. Dates of both reared and field collected specimens range from May 27 to July 31 (1941–1943).

In appearance *comandranum* reminds one of *merrickanum* Kearfott but lacks the conspicuous subterminal spot and long, pale, oblique line of that species. The genitalia, however, indicate a closer affinity with *E. foedanum* (Clemens) from which it differs by the shorter digitus and longer, stouter spine of Spc², and the presence of a small but well-defined signum.

Endothenia microptera, n. sp.
Figs. 6, 6a, 6b

Alar expanse, 10–12 mm.

Labial palpus buff with some fuscous shading exteriorly on second segment; third segment almost wholly fuscous. Antenna fuscous; scape paler. Head grayish with some light brown mixed on vertex. Thorax and ground color of forewing grayish fuscous with darker and ligher markings, the whole appearing mottled; thorax and tegula with narrow, transverse, buff bands; posterior tuft of thorax fuscous; basal patch, an irregular, median, transverse fascia and a slightly curved, transverse bar from vein 8, near end of cell, to vein 5 before termen, fuscous; dark markings separated by leaden-metallic fasciae and spots; on dorsum, about middle of wing, a leaden-metallic spot preceded and followed by a slender buff line; costa with three pairs of short buff strigulae before the dark transverse fascia and three pairs of similar strigulae beyond; cilia leaden-metallic preceded by a narrow fuscous subbasal line. Hind wing fuscous; cilia grayish with dark subbasal line. Legs buff, overlaid and banded with fuscous. Abdomen fuscous above, buff beneath.

Male genitalia.—Harpe as figured. Uncus very broad, tuberculate. Cornutus one, small, with large bulbous base.

Female genitalia.—Ovipositor not figured; remainder as shown.

Type.—U.S.N.M. no. 61485.

Type locality.—Putnam County, Ill. (August 14, 1949).

Food plant.—Unknown.

Remarks.—Described from the type male and 3 male and 4 female paratypes all from the same locality. Dates range from June 12 to September 2 (1946–1949).

In size *microptera* approaches *E. conditana* (Walsingham), to which it is most nearly related. The markings of *microptera* are more pronounced than those of *conditana*, and the former has six pairs of fine, well-defined, buff strigulae on costa of forewing not found in *conditana*. The uncus of *microptera* is about twice as broad as that of *conditana*, the aedeagus is broader and shorter, and the cornutus is less than half the size.

EXPLANATION OF FIGURES

FIGS. 1–1b.—*Eucosma uta*, n. sp.: 1, Left wings; 1a, left harpe; 1b, ventral view of female genitalia with ovipositor removed.

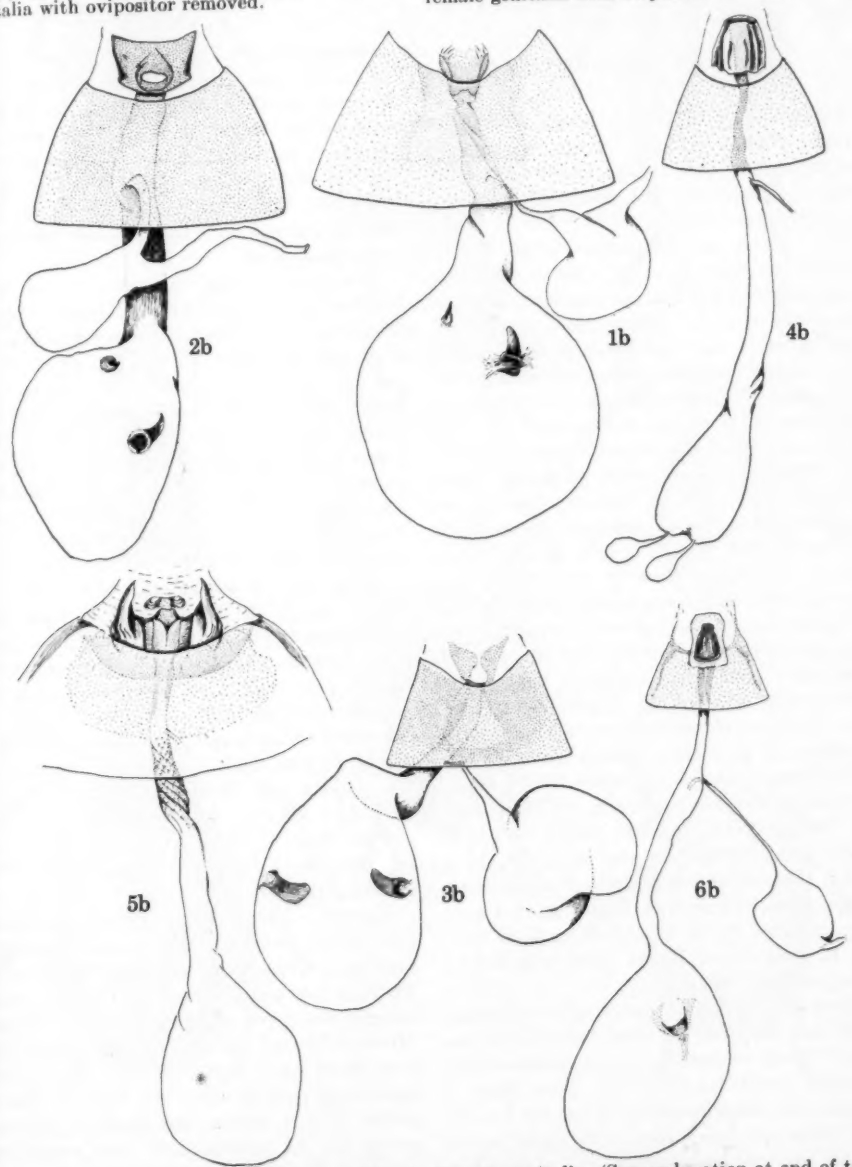
FIGS. 2–2b.—*Epiblema naoma*, n. sp.: 2, Left wings; 2a, left harpe; 2b, ventral view of female genitalia with ovipositor removed.

FIGS. 3–3b.—*Epinotia atristriga*, n. sp.: 3, Left wings; 3a, left harpe; 3b, ventral view of female genitalia with ovipositor removed.

FIGS. 4–4b.—*Polychrosis sambuci*, n. sp.: 4, Left wings; 4a, left harpe; 4b, ventral view of female genitalia with ovipositor removed.

FIGS. 5–5b.—*Exartema comandranum*, n. sp.: 5, Left wings; 5a, left harpe; 5b, ventral view of female genitalia with ovipositor removed.

FIGS. 6–6b.—*Endothenia microptera*, n. sp.: 6, Left wings; 6a, left harpe; 6b, ventral view of female genitalia with ovipositor removed.



FIGS. 1b–6b.—New Olethreutidae from Illinois: Female genitalia. (See explanation at end of text.)

ENTOMOLOGY.—*Eight new Neotropical chrysomelid beetles (Coleoptera).* DORIS H. BLAKE, Arlington, Va.

This paper is composed of the descriptions of eight new Neotropical chrysomelids, two from the West Indies, one from Peru, one from Mexico, and four from Costa Rica.

Phaedon barberi, n. sp.
Fig. 8

Between 6.5 and 7.5 mm in length, shortly and broadly ovate, moderately convex, shining, very finely punctate, pale reddish brown with black antennae, scutellum, and undersurface, except prosternum, and legs.

Head broad and flat across vertex, surface polished and finely punctate, a faint median line connecting with a V line running down on either side to the antennal sockets, lower front short, finely punctate, tip of jaws dark. Antennae short, dark, the five basal joints narrow, remaining distal joints much thickened and compressed. Prothorax more than twice as wide as long, with the sides curving forward so as to conceal the eyes from the sides partially, a rather coarse punctation along the lateral margins to basal margin and on anterior margin behind the eyes, more finely punctate on disc. Scutellum dark. Elytra broad, convex, a distinct humeral callosity, surface shining, distinctly but not coarsely punctate, the punctures not striate but with a tendency toward striation. Body beneath and legs shining, often with a bluish or metallic luster, prosternum pale except in the middle about coxae. First abdominal segment not a great deal longer than second. Hind tibiae a little curved. Claws simple. Length 6.5–7.5 mm; width 4.6–5.5 mm.

Type male and 9 paratypes, U.S.N.M. type no. 61616, collected by R. G. Oakley at Yauco, Puerto Rico, February 9 and March 28, 1933. In the Museum of Comparative Zoology, Cambridge, Mass., 5 paratypes from Yauco, Puerto Rico, collected by R. G. Oakley in April 1934, and 12 from Lares, Puerto Rico, collected by Oakley in April 1934.

Remarks.—This, the second species of *Phaedon* to be described from the West Indies, is not entirely typical, not having striate-punctate elytra. *Leucocera ferruginea* Chevrolat from Haiti is similar in its ferrugineous coloration but has the pale yellow antennae typical of the genus as well as pale legs and undersurface, and is definitely striate-punctate. This is a species that had been set aside for future description by H. S. Barber.

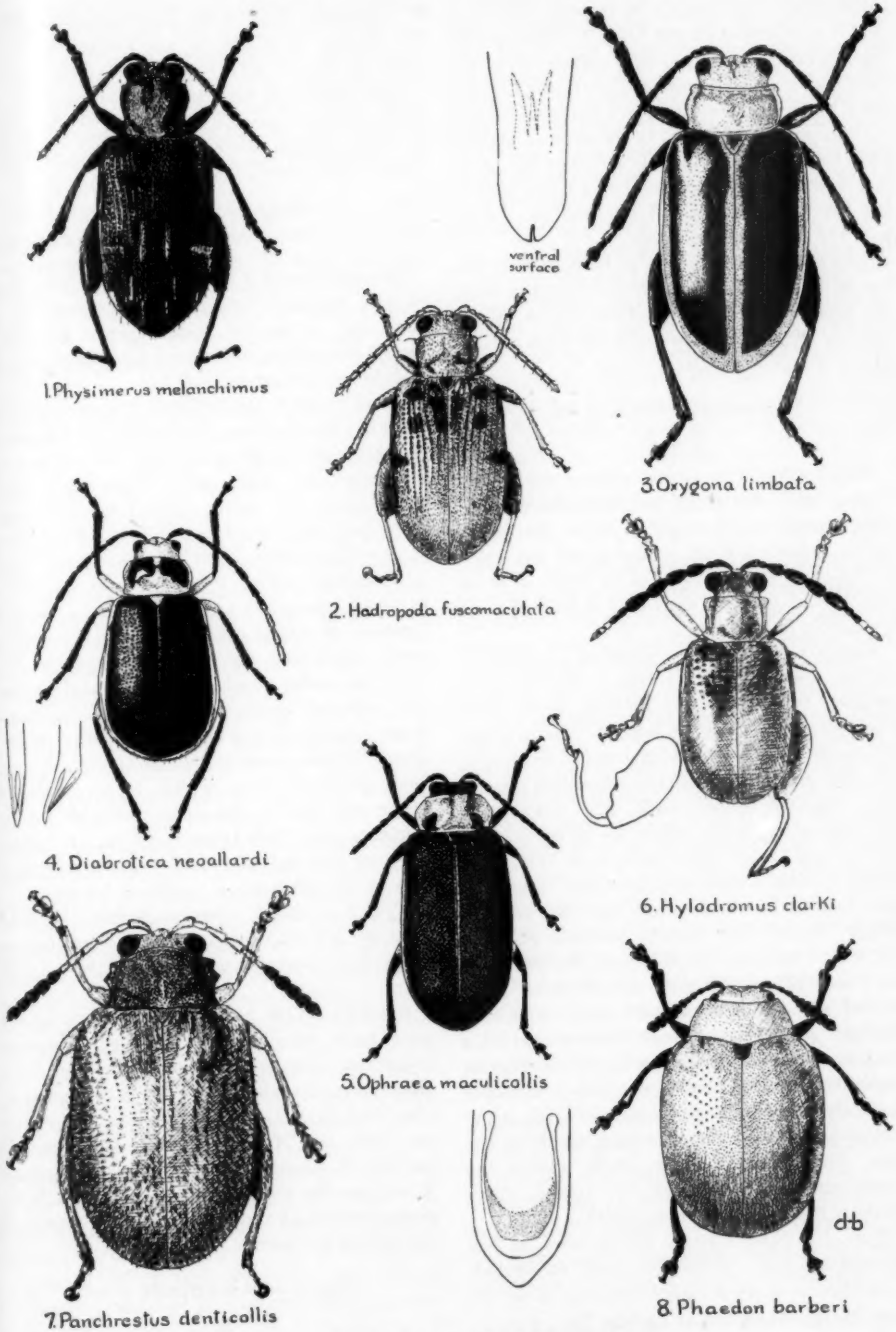
Diabrotica neoallardi, n. sp.
Fig. 4

About 6.5 mm in length, elongate oval, moderately shiny although alutaceous, the prothorax finely and the elytra coarsely punctate, the head, undersurface, femora, borders of the prothorax and elytra, and scutellum pale yellow, two piceous spots on the prothorax nearly covering the anterior half, the elytra, except the margin, deep blue, tibiae and tarsi and antennae except the apical joints dark.

Head pale, orange-yellow on top and yellow on the lower front, smooth, faintly shining, alutaceous, frontal tubercles clearly marked with a median depression above them. Antennae extending below the middle of the elytra, very slender and hairy, third joint a little shorter than fourth, remainder subequal, dark, the three distal joints mostly pale. Prothorax a little less than twice as broad as long with curved sides and a somewhat curved transverse depression below the middle, finely alutaceous and distinctly punctate, pale yellow with two broad piceous areas covering most of the anterior half of the prothorax except the margin and curving down towards the basal angles. Scutellum pale. Elytra wider toward apex, with a wide explanate margin that is pale, dark blue over disc, densely and coarsely punctate and alutaceous, slightly pubescent at the apex and about the apical margin. Epipleura pale. Body beneath entirely pale yellow, femora pale, tibiae and tarsi piceous and very hairy. Length 6.7 mm; width 3.4 mm.

Type male, U.S.N.M. type no. 61617, collected by H. A. Allard at Tinga María, Peru, winter of 1949–50.

Remarks.—Except for the unusual dark markings on the prothorax, this species resembles a number of species of *Diabrotica* with dark elytra having a pale margin, but I have hunted vainly through the types of *Diabrotica* in the British Museum for one like it. *D. albidocincta* Baly from Brazil has a dark head and thorax with a pale margin, and the elytra are black. *D. limbatipennis* Baly is smaller and similar in coloring except for the prothorax. *D. cinctipennis* Baly also from Peru has deep blue or green elytra, and



FIGS. 1–8.—New Neotropical Chrysomelidae.

the prothorax has a dark vitta on each side. There is also a dark spot on the head. *D. digna* Gahan from Brazil is very shiny and without dark thoracic markings. *D. flavocincta* Baly from Colombia has a black head and the elytra are parallel-sided with impunctate surface. *D. flavomarginata* Baly from Colombia has minutely punctate elytra. *D. staudingeri* Baly from Colombia, a larger species, has the lateral margin of the prothorax alone pale and is coarsely punctate.

This species is dedicated to H. A. Allard who has collected a great many botanical and zoological specimens not only in Peru but elsewhere. There is already a *D. allardi* Jacoby from Mexico, named for another Allard.

Ophraea maculicŏllis, n. sp.

Fig. 5

About 4.5 mm in length, oblong oval, feebly shining under the short, pale, appressed pubescence, densely and coarsely punctate, black with the lower front of head, prothorax and basal part of femora pale, the prothorax with a black longitudinal spot on each side extending from the middle to the base.

Head coarsely punctate, a median groove down occiput, space between antennal sockets feebly carinate, tubercles poorly marked, lower front from antennal sockets to labrum pale and likewise punctate, mouthparts and rest of head dark, with fine pale pubescence not concealing punctation. Antennae entirely dark, third joint longer than succeeding joints which are subequal. Prothorax just about twice as wide as long, sides rounded, almost angulate, depressed deeply on each side and in the middle near the anterior margin; densely and coarsely punctate, pale yellow with a spot on each side from the middle to the base. Elytra elongate, parallel-sided, with sutural edges a little raised, coarsely and contiguously punctate, with each puncture having a flat reflecting bottom, so that the whole sparkles somewhat; a fine appressed pale pubescence, not concealing surface. Epipleura wide, coarsely punctate and pubescent and extending nearly to the apex. Body beneath shiny, black, except the prosternum and basal half of femora, claws toothed. Length 4.5–4.6 mm; width 2 mm.

Type, U.S.N.M. type no. 61618, taken at San Francisco, Calif., March 20, 1939, on orchids from Mexico. A second specimen, also on orchids from Mexico was taken at Laredo, Tex., January 29, 1945.

Remarks.—None of the eight species described by Jacoby from Mexico and Central America, which constitute all the species previously known in the genus, has markings such as occur on the thorax of this species, although one, *O. opaca*, has a broad median black stripe, and *O. subcostata* has a broad central black band.

Oxygona limbata, n. sp.

Fig. 3

Between 8 and 9 mm in length, oblong oval, shining yellowish brown, the antennae, tip of jaws, legs, breast and abdomen, and the elytra except for suture and lateral margins deep reddish brown, almost piceous.

Head rounded and polished over occiput with a median groove down the front to the tubercles, the tubercles rounded and swollen, the interantennal area below them rather depressed without much trace of a carina, jaws large and dark. Antennae long, slender and dark, third joint shorter than fourth, joints 4 to 7 subequal, distal joints a little shorter. Prothorax more than twice as broad as long with curved sides and prominent toothing at anterior and basal angles, surface faintly alutaceous and very finely punctate with a row of coarser punctures along lateral margin, pale yellowish brown with faintly deeper brown traces of a transverse fascia. Scutellum reddish brown. Elytra broader than prothorax, shining, finely punctate, deep reddish brown, with the suture and lateral edges pale yellowish brown; epipleura pale. Body beneath shining, the breast, abdomen and legs deep reddish brown verging on piceous. Length 8–9 mm; width 2–4.5 mm.

Type male and 2 paratypes female, U.S.N.M. type no. 61619, collected on *Solanum torvum*, Guadalupe, Costa Rica, May 25, 1936, by E. Marin.

Remarks.—This is the third species of the genus to be described from the North American Continent. The dark color pattern of the elytra differs from the pale-yellow-colored *O. acutangula* Chevrolat, and *O. bifasciata* Jacoby, the second one from the North American Continent, is banded. *O. adumbrata* Clark, from the Amazon River, has the elytra clouded with dark ferrugineous except at the margin, but the femora in this species are pale.

Panchrestus denticollis, n. sp.

Fig. 7

About 6.5 mm in length, broadly oblong oval,

faintly shining reddish brown under a yellowish brown pubescence, the head and prothorax coarsely and densely punctate, the elytra less coarsely and striately punctate, the antennae pale with joints 7 to 11 much thickened and dark; prothorax with three sharp lateral teeth on each side, hind tibiae appearing double spurred at apex.

Head with interocular space a little more than half width of head, coarsely and densely punctate over occiput and with short yellow-brown pubescence, frontal tubercles prominent with a deep groove between, space between antennal sockets wide and a little produced, this carina very short, a triangular depression below over labrum, the lower front unusually short, labrum large. Antennae not very long, basal joints pale, first and third longest, sixth joint shorter and thinner than fourth or fifth, about the length of second joint, joints 7 to 11 dark, very hairy, and fully twice as wide as basal joints. Prothorax short compared with the elytra, not twice as wide as long, moderately convex with an oblique depression below the middle on each side, the sides 3-toothed, the sharp apical angle forming one tooth, the second below this before the middle, and the third not so sharp at the basal angle; the surface of the disc contiguously and coarsely punctate and with short erectish yellow brown pubescence, much rubbed in this specimen. Scutellum densely pubescent. Elytra much wider than prothorax, moderately convex and shining beneath the yellowish-brown suberect pubescence, the pubescence in this specimen probably rubbed from the central portion but on the sides and the apex the hairs tending to mat together at the tips forming little cone-shaped tufts. Striate punctures not coarse but darker in coloring and toward the apex becoming somewhat indistinct. Epipleura broad and extending nearly to the apex. Body beneath and legs shining reddish brown, the posterior femora much thickened and with considerable yellowish-brown pubescence, posterior tibiae short and straight, ending in a sharp spur with another inserted before the end, the posterior first two tarsal joints thinner and shorter than the corresponding ones in the anterior legs. Anterior tarsal claws appendiculate, with the basal tooth sharp. Length 6.5 mm; width 3.3 mm.

Type, U.S.N.M. type no. 61620, collected on the western slope of the Irazu Volcano, Costa Rica, 1,500 to 2,000 meters, by T. Assmann, on April 30, 1926, from the Nevermann collection.

Remarks.—The Rev. Hamlet Clark's Catalogue of Halticidae, part 1, has been criticized by both Jacoby and Weise because of the numerous genera that he has made. Anyone who has examined the Neotropical Oediopodes is struck by their great diversity of form and the difficulty of cataloguing them under a few genera. Bowditch[1] wrote of attempting "to squeeze" a number of species that he was describing into Clark's genera, but apparently with no great faith that they belonged in those genera, rather than describe any new genera. So I am placing this very distinct species under Clark's *Panchrestus*, chiefly because Clark in describing *P. pulcher* from the Amazon wrote of that species as having a toothed prothorax and with the antennal joints much thickened and darker toward the end. This toothing of the prothorax is unusual, and I know of no other species with it in this group.

Hadropoda fuscomaculata, n. sp.

Fig. 2

About 4.5 mm in length, oblong oval, faintly shining, pale yellow brown with pale yellowish pubescence, the elytra with a reddish brown area from the humerus across to the suture and down, a reddish-brown spot below in the middle and one near the margin halfway down the elytra.

Head entirely pale, the interocular space about half the width of the head, occiput coarsely and densely punctate with a thin median ridge and on either side a ridge from near the eye to the tubercles, tubercles well defined, a narrow carina between antennal sockets running down the lower front, lower front long. Antennae pale brown, not extending much below the humeri, fourth joint longer than third and subequal to fifth and sixth, remainder shorter. Prothorax a little wider than long with nearly straight sides slightly constricted near the base, a seta-bearing nodule at each corner, disc uneven, the anterior middle being convex and below on either side with a hollowed out depression, surface densely and moderately coarsely punctate and with short fine pubescence. Scutellum reddish brown. Elytra much wider than prothorax, rather flat and without callosities or depressions, with moderately coarse striate punctures, faintly shining under the short pubescence, pale yellow-brown with reddish-brown spots, a brownish area from the

[1] Bowditch, Trans. Amer. Ent. Soc. **41**: 498. 1915.

humerus to suture and down, another spot slightly below in the middle and another on the side at the middle of the elytra; epipleura pale and wide and extending nearly to the apex. Body beneath pale, shining, lightly pubescent, the hind femora with more pubescence and greatly thickened, hind claw inflated. Length 4.6 mm; width 2.2 mm.

Type, female, U.S.N.M. type no. 61621, taken at Miami, Fla., from a plane from Natal, Brazil, via Puerto Rico, January 15, 1943.

Remarks.—Although there is no definite locality for this beetle, the fact that it came from a plane that flew from Natal, Brazil, to Florida by way of Puerto Rico makes it pretty certain that the beetle came aboard in the neighborhood of the West Indies, and quite probably Puerto Rico, as it is a typical *Hadropoda*, a group of beetles that so far has been found only in the West Indies. It differs from any of those previously described in its elytral markings. *H. calva* Blake, from the Dominican Republic, is a little smaller beetle with somewhat similar spotting but has longer antennae.

Hylodromus clarki, n. sp.
Fig. 6

About 4 mm in length, elongate oblong oval, very shiny, deep reddish brown with pale yellow anterior legs, hind femora reddish brown, paler at apex and on underside, antennae with the first eight joints deep brown, rest paler, joints 3 to 6 much enlarged; elytra finely striate punctate with coarser punctures in the depression below the basal callosity, hind femora with a prominent nodule in middle of lower surface and a tooth below that.

Head with large protuberant eyes, the interocular space about half width of head, occiput shining reddish brown, a single puncture in middle and a fovea on either side, frontal tubercles swollen, a deep groove above and between them; antennal sockets very close and the space between them slightly carinate, this swelling very short and not extending down the lower front, the lower front short, labrum wide. Antennae more than half the length of the beetle, joints 3 to 6 enlarged to twice the width of the first two and longer than the basal joint, joints 7 to 11 abruptly narrowed and short, joints 1 to 8 dark brown, 9 and 10 pale, 11 light brown. Prothorax scarcely a third wider than long with large basal and apical toothing and concave sides narrowly margined, disc a little depressed in basal part, shining deep reddish brown, finely punctate. Scutellum a little deeper brown than the reddish-brown elytra, elytra with prominent humeri and deep intrahumeral depression, also a broad and deep depression below the basal callosity, finely and striately punctate except in the depression, toward the apex and on sides the punctures becoming faint and disappearing. Epipleura broad and extending nearly to apex. Body beneath shining reddish brown, the anterior pairs of legs and underside and apex of hind femora pale yellow, hind femora with a prominent nodule at the middle on lower side and below this a tooth, hind femora slender, bowed and long, nearly glabrous, at the tip ending acutely and with a spur, thus making it appear two spurred, claw joint inflated. Length 4.3 mm; width 2 mm.

Type male, U.S.N.M. type no. 61622, collected at Hamburgfarm, Reventazon, Ibene Limón, Costa Rica, on March 28, 1930, by F. Nevermann.

Remarks.—I have not examined Clark's species *H. dilaticornis* from the Amazon River, on which the genus *Hylodromus* is based, but have seen a cotype of *H. basalis* Jacoby from Panama. Possibly neither Jacoby's species nor mine belongs in Clark's genus, in which the third to sixth antennal joints are dilated and flattened and in which the body is pubescent. In the first two species the antennal joints are dilated but not flattened, and the beetles are shining and nearly glabrous except for a few scattered hairs near the apex and along the apical margin and, as Jacoby himself stated, resemble a great deal *Homammatus nitidus* Clark except for the antennal dilation and the peculiar curvature of the hind tibiae which is present in all three species. Whether Jacoby's and my species are congeneric with Clark's or not, I do not see any reason why Weise[2] should synonymize *Hylodromus* with *Euphenges*, and I hereby reestablish Clark's genus *Hylodromus* and dedicate this species to him. *H. basalis* Jacoby closely resembles *H. clarki* but differs somewhat in coloring, having a darker head and prothorax. There is some difference in the color of the antennal joints, also; in *H. clarki* the first eight instead of seven joints are dark. *H. basalis* also has a wider and deeper intrahumeral sulcus and stouter, more pubescent hind tibiae.

[2] Weise, Ark. för Zool. **14:** 153. 1921.

Physimerus melanchimus; n. sp.
Fig. 1

About 5 mm in length, oblong oval, shining black beneath the fine appressed pubsecence, prothorax narrow, constricted before the base, with a median callosity anteriorly, elytra with a basal callosity on each side of the scutellum, coarsely and striately punctate, the pubescence with paler areas in the form of traces of vittae and an interrupted fascia in the apical half.

Head entirely black with large eyes, interocular space scarcely half the width of the head, occiput coarsely punctate and with a fine median ridge and on either side a groove from the eye to the tubercles, tubercles swollen, carina between antennal sockets short and narrowly produced, lower front long with large mouthparts. Antennae with third joint longest, joints 3 to 5 deep brown, joints 6 to 8 black and thicker, joints 9 to 11 brown and thin. Prothorax as long as wide with a tiny seta bearing nodule at each corner, constricted before the base, a callosity in middle anteriorly and a depression on each side below this near base, surface entirely dark, covered with fine appressed pubescence. Scutellum dark and pubescent. Elytra considerably wider than prothorax, entirely dark except for the pale pubescence in the pattern of interrupted vittae and an interrupted fascia below the middle in apical half, shining beneath the pubescence, rather coarsely striate punctate, the interstices raised in slight costae, a callosity on each side of the scutellum with a depression below it; epipleura black and shiny and wide to the apical curve. Body beneath shining black, with a light pubescence except on the hind femora that are more pubescent, hind claws inflated. Length 4.4–5 mm; width 2–2.2 mm.

Type male, U.S.N.M. type no. 61623, Las Mercedes, Costa Rica, October 30, 1922, from the Nevermann collection. One other specimen, a female, collected by N. L. H. Krauss at El Valle, Panama, January 1947.

Remarks.—The antennae of this species, in having joints 6–8 thickened, resemble the antennae of *Homammatus nitidus* Clark, an entirely glabrous species that is much more robust.

MAMMALOGY.—*A new hedgehog from Africa.* HENRY W. SETZER, U. S. National Museum.

In cooperation with the United States Naval Medical Research Unit No. 3 and the Chicago Natural History Museum, studies have been started on the mammals of the Anglo-Egyptian Sudan and Egypt. As a result of these studies the hedgehog from the Sudan has been found to differ from the kinds known to inhabit adjacent areas. It is with great pleasure that I name this interesting mammal for J. S. Owen, District Commissioner, Torit, Equatoria Province, Anglo-Egyptian Sudan, who did so much to make the field work of the Unit a success. All measurements are in millimeters, and the capitalized color terms are from Ridgway's *Color standards and color nomenclature.*

Erinaceus (Atelerix) pruneri oweni, n. subsp.

Type.—Chicago Natural History Museum, no. 67047, adult female, skin and skull, from Torit, 2,000 feet, Equatoria Province, Anglo-Egyptian Sudan. Obtained April 9, 1950, by Harry Hoogstraal, original no. 5478.

Specimens examined.—Seven, all from Torit.

Distribution.—Known only from the type locality.

Diagnosis.—Spines of upper parts longitudinally striated and marked with the following pattern: Army Brown followed successively by a band of pure white (2 to 4 mm), a band of Army Brown shading into black (5 to 6 mm), a band of grayish white (2 to 4 mm), and a black base (2 to 4 mm); a few spines are entirely white. The ears and the muzzle to immediately behind the eyes Olive Brown; dorsal surfaces of hands and feet Snuff Brown with a generous admixture of white hairs; mystacial vibrissae black; forehead, shoulders, sides of body, upper parts of limbs, and belly with pure white hairs. Palms and soles naked; hind foot four toed. Skull robust; rostrum relatively narrow; width across zygomatic arches relatively small; nasals rather wide and long; lambdoidal crest moderately developed; upper molars relatively massive.

Measurements of type specimen.—Total length 215; length of tail 24; length of hind foot 32;

length of ear 29; condylobasal length of skull 43.9; length of palate 25.2; width of rostrum at level of infraorbital foramen 11.6; length of nasals 13.1; least width behind postorbital processes 11.4; width across zygomatic arches 26.7.

Comparisons.—Erinaceus pruneri oweni differs from *Erinaceus pruneri hindei*, as known from Ulukenia Hills and Kapiti Plains, British East Africa, as follows: Dorsal color somewhat darker but hands and feet lighter; rostrum decidedly narrower and longer; width across zygomatic arches less; nasals wider and longer; occipital region more nearly perpendicular; lambdoidal crest, in animals of comparable age, more developed; molars more robust; P^2 decidedly larger; postpalatal bridge less developed.

No specimens of *Erinaceus pruneri atratus* are available, but from the description, *E. p. oweni* is lighter in color and larger in all measurements taken. Also, it is apparent that *Erinaceus pruneri pruneri* is different in that the area immediately below the eye is white whereas in *E. p. oweni* this region is dark.

Remarks.—There is some variation in color of these specimens, but this is probably owing to the manner in which the skins have been prepared. If the spines are laid flat in preparation the general tone, as observed from above, is a smoky color; if the spines are semierect the color is darker. Another contributing factor is the amount of pigment on the tip of the spines. If this is slight the general effect is lighter and conversely if there is a relatively wide band at the tip the color appears darker. The only immature specimen in the series is decidedly darker in color than any of the adults. In all specimens except one, the maxillary bone touches the nasal on each side for at least 1.5 mm.

All the specimens were obtained in savanna type country between January 7 and April 9.

Obituary

IDA ALBERTINA BENGTSON.—A pioneer woman of science passed away on September 6, 1952. Born in Harvard, Nebr., on January 17, 1881, of parents who were Swedish immigrants, Ida A. Bengtson received a liberal education which led to an A.B. degree from the University of Nebraska in 1903. In those days few women were interested in the physical and biological sciences, and these subjects were not among Ida Bengtson's interests. She majored in languages and mathematics. She was elected to Phi Beta Kappa.

Shortly after graduation she came to Washington to be a cataloger in the library of the U. S. Geological Survey. She became acquainted with one of the few women who at that time held Federal Civil Service positions in science. She compared her own professional life with that of her friend and decided that for her the life of a scientist would be more interesting than that of a keeper of scientific books and records.

In Ida Bengtson ideas led to action. She resigned from the U. S. Geological Survey in 1911 and entered the University of Chicago to study bacteriology, with chemistry and physiology as minor subjects. She received the M.S. degree in 1913; held a university scholarship for two years; and received the degree of Ph.D. in 1919. After a year as bacteriologist in the Chicago Department of Health, she was appointed in 1916 to be an assistant bacteriologist in the Hygienic Laboratory (now designated the National Institutes of Health) of the United States Public Health Service, with an annual salary of $1,800. She was the first woman of science in U.S.P.H.S. Low as her entrance salary appears when compared with those of the present time, it was very good in those days. Dr. Bengtson told about the astonishment among her professors and fellow graduate students when she, a woman, received so attractive an appointment.

Within the next 20 years, eight or ten more women entered the Hygienic Laboratory as scientists. In obtaining their positions it was well for all of them that the pioneer woman, who by that time was a senior bacteriologist, was filling her position so ably.

In scientific investigation Dr. Bengtson was painstaking and thorough; her conclusions were conservative. In teamwork she was capable and amicable. She was a good teacher, and for a few weeks annually for many years she had opportunity to exercise that talent as one of the instructors of the orientation class of incoming medical officers. Other evidence of her ability

as a teacher remains in the competent *dieners* at the National Institutes of Health who were so fortunate as to receive training under her.

Dr. Bengtson was the sole or senior author of many papers, most of which were published in Public Health Reports or in bulletins of the Hygienic Laboratory or National Institute of Health. She published a number of papers on miscellaneous bacteriological subjects, most of them appearing during the early years of her career. She made a prolonged study of three subjects: (1) anaerobes and their toxins; (2) trachoma; (3) rickettsial diseases.

Dr. Bengtson's work on anaerobes and their toxins covered two periods. During the earlier period (1920–1923) *Clostridium botulinum* was of especial interest to her. In the course of these studies she experienced the thrill of discovery when she identified a new variety, "C," of the organism, which she obtained from a culture grown from larvae of the green fly, *Lucilia caesar*. The toxin was responsible for an outbreak of paralytic disease (limberneck) in chickens. During the later period (1934–1939) she carried on basic studies which led to the establishment of the official U. S. and international units for standardizing the antitoxins specific for the four toxins most commonly involved in cases of gas gangrene—those produced by *Clostridium perfringens*, *C. oedematiens*, *C. septicum*, and *C. histolyticum*.

In 1924 Dr. Bengtson went to Rolla, Mo., to study the etiology of trachoma in the U. S. Public Health Service Trachoma Hospital. It was a difficult problem, not yet solved. The seven years spent in Rolla were marked by a slowing in the publication of scientific papers. The experience in Rolla was, however, a good preparation for Dr. Bengtson's later assignment, because among the various organisms which she considered as a possible causal agent of trachoma were the rickettsia.

In 1937, as a member of the "typhus unit," the study of rickettsial diseases became Dr. Bengtson's major assignment. This unit was comprised of a team which studied the rickettsial diseases of Rocky Mountain spotted fever, endemic and epidemic typhus. Later, "Q" fever and Tsutsugamushi disease (scrub typhus) appeared and were included in the studies.

An important problem for the bacteriologist in the study of rickettsial diseases was to find a method of growing the organisms free of tissues in quantities sufficient for making serological diagnostic tests. In 1938 Herald R. Cox of the U.S.P.H.S. Rocky Mountain Laboratory discovered that the yolk sac tissue of the developing chick embryo provided a suitable medium for prolific growth of rickettsiae. Dr. Bengtson was in a position to put this discovery into immediate practical use, and she entered into the most productive period of her career.

She modified the complement fixation test (a serologic test) adapting it for the detection and differentiation of rickettsial infections. It was also of great value in the study of serum from man and from rats (a species which harbors the typhus virus) for the purpose of detecting past infections. Dr. Bengtson's technique is now in wide use.

She had done some of the early work in the tissue culture of typhus rickettsiae which was of great importance in the subsequent development of the vaccine which played such an important part in the protection of our troops against typhus, one of the major wartime diseases. As World War II progressed the demands upon Dr. Bengtson increased, with many questions constantly being raised regarding rickettsial infections in the Armed Forces. Dr. Norman Topping, who was chief of the Rickettsial Unit during World War II praised her in these words: "Dr. Bengtson was an indefatigable worker, a true disciple of the scientific method, and loyal to her country, her institution and her colleagues." She retired in 1946.

Dr. Bengtson was a member of numerous scientific organizations including Society of American Bacteriologists; Society for Experimental Biology and Medicine; American Association for the Advancement of Science (fellow); Washington Academy of Sciences; Sigma Xi. She was president of the Washington Branch of the Society of American Bacteriologists in 1943–44, and Councilor from the Branch to the National S.A.B. during 1945 and 1946. She was awarded the Typhus Medal of the American Typhus Commission in 1947.

During the period of her greatest scientific activity, Dr. Bengtson found diversion on her farm, which with its big house of colonial architecture is beautifully located in the foothills of the Blue Ridge Mountains of Virginia. She was

endowed with great endurance, and after a week of heavy duty she could turn with equal facility and skill to the management of her 370 acres. Although she had not had previous experience of living on a farm, she had inherited a love of the land from a long line of Swedish ancestors. During the ten years of her ownership she converted the status of her farm from nonproductive to productive. She was interested in historic homes and made many trips around the country to see them, especially during garden week.

Ida Bengtson was gentle, pleasant, friendly, rather reserved; she had a keen sense of humor which she tried to keep hidden, but a faint twinkle in her eyes usually gave her away. Her death brought sorrow and a feeling of deep loss to her friends.

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